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THE GEOGRAPHICAL JOURNAL

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The 'Geographical Journal' is registered for transmission to Canada by Canadian Magazine Post.

ROYAL GEOGRAPHICAL SOCIETY

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NOTICES

SESSION 1927–1928.

The following are the Dates for the Evening and Afternoon Meetings of the Session.

EVENING MEETINGS at 8.30 p.m. ÆOLIAN HALL.	AFTERNOON MEETINGS at 5 p.m. MAP ROOM, Lowther Lodge.
Monday, November 7 and 21	Monday, November 14
December 5 and 19	December 12
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February 6 and 20	February 13
March . 5 and 19	March . 12 and 26
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LIST OF FELLOWS. 1927. Fellows are asked to notify any change of Address or Rank for the new List of Fellows, which will be corrected up to 30 September 1927 and published as soon as possible after that date. Those Fellows who wish to receive the list free of charge should notify the Chief Clerk by October 20.

PHOTOGRAPH ROOM. The attention of Fellows is called to the water-colour sketches of Asia Minor, Syria, and 'Iraq made by Mr. Lionel Muirhead between 1868 and 1870 now exhibited.

THE SOCIETY'S HOUSE. The House is open on week-days from 10 a.m. to 6 p.m.

By Order of the Council,
ARTHUR R. HINKS,
Secretary.

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

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The privileges of a Fellow include admission (with one Friend) to all ordinary meetings of the Society, and the use of the Society's House, Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications.

The Geographical Journal

Vol. LXX No. 3 September 1927

PROBLEMS OF THE LIBYAN DESERT

John Ball, O.B.E., D.Sc., M.Inst.C.E., F.G.S., Director of Desert Surveys, Egypt

(*Continued from p.* 128.)

10. *The "Tortoise Marshes" of Ptolemy.*

THE passage in Ptolemy's 'Geographia' (lib. IV. cap. 6, sect. 4) in which the position of the "Tortoise Marshes" is given may be translated as follows *:

> There are two great rivers running into the Mediterranean; one of them is the Gir, joining Mount Usargala with the Garamantic narrows, from which, changing its course, the river is located in long. 42°, lat. 16°, and makes the Tortoise Marshes (Chelonitides Paludes), whose position is long. 49°, lat. 20°.

The information on which Ptolemy based this statement, at least as regards the river *Gir*, must have been very fragmentary, if not, indeed, grossly erroneous; for there is no river flowing to the Mediterranean anywhere near the positions he gives. But there can be little doubt that his names *Gir* and *Chelonitides Paludes* refer to real places, and there has been much speculation among geographers as to their identification.

Thus, for instance, Knoetel † suggested that the *Gir* may have been the Wadi Djedi, to the south of Biskra, and the Tortoise Marshes the modern Lake Melghir (lat. 34°, long. 6°).‡ Dr. William Smith § thought that the *Gir* was really a branch of the Niger, and the marshes the modern Lake Fittri (lat. 13°, long. 18°). On the map of Africa on the 2-million scale published by the Geographical Service of the French Army in 1899 the Tortoise Marshes are depicted as lying in about latitude 19° 20′,

* There exists no published English translation of Ptolemy's 'Geographia.' Müller's edition (Paris, 1883–1901) gives Greek and Latin texts, with a Latin commentary.

† Quoted in Müller's edition of Ptolemy's Geography, p. 739.

‡ For the latest delineation of this region, see the hypsometric map in the 'Atlas de l'Algérie et de Tunisie,' published by the Cartographic Service of the Algerian Government, Paris, 1924, Fascicule II.

§ 'Manual of Ancient Geography' (London, 1891), p. 311.

longitude 27°, with a note stating that this delineation is taken from an earlier map of the Nile Basin by Miani, who regarded the marshes as being connected with the "dry river" which was then supposed to run northwards through Dakhla Oasis. Colonel Tilho has lately suggested* the lowlands to the north-east of Lake Chad (lat. 18°, long. 17°) as a possible site for the marshes; while still more recently Mr. Harding King † has thought that they might perhaps be identified with the salt lake of Merga (lat. 19° 3′, long. 26° 19′).

Of the various localities which have been suggested as possible sites for the Tortoise Marshes, the only one which I have visited is Merga. I found the salt lake at that place to be very small, covering only some 10 acres; it lies at an altitude of 509 metres above sea-level, and though it is situated in a rather wide shallow depression, I saw no traces of any extensive salt-marshes around the lake, while the configuration of the surrounding country appeared to me to be such that the depression cannot possibly have formed part of a continuous drainage-channel.

I do not know whether it has hitherto been suggested that Kufra Oasis may be the site of the Tortoise Marshes; but on correcting Ptolemy's figures for the errors in his adopted position for Alexandria and in the length which he assumed for a degree of latitude, I find Kufra is in very much closer agreement with them than any of the places named above. In Ptolemy's day, even the latitudes of but few places had been astronomically observed (Alexandria, where he himself resided, was supposed by Ptolemy to be in latitude 31°, instead of its true 32° 12′), and as the only method at that time known for astronomically determining differences of longitude was by the observation of eclipses, the number of observed longitudes was smaller still. The process by which Ptolemy deduced his position for the Tortoise Marshes and other places in the interior of Libya was most probably that of first estimating their distances south and west of Alexandria from travellers' itineraries, then converting these distances into degrees of latitude and longitude, and finally subtracting the differences thus found from the latitude and longitude of Alexandria. But Ptolemy made the great mistake of assuming the length of a degree of latitude (or of equatorial longitude) to be 500 stades, instead of the 700 stades which it really is. Thus all his dead-reckonings resulted in differences of latitude and longitude which were too great in the proportion of seven to five. If we correct Ptolemy's position for Alexandria, and his dead-reckoning for the erroneous assumption which he made regarding the size of the Earth, as follows:

	Latitude.	*Longitude.*
Ptolemy's position for Alexandria	31°	60° 30′
Ptolemy's position for the Tortoise Marshes ..	20°	49°
Ptolemy's difference of lat. and long.	11°	11° 30′

* *Geogr. Journ.*, 56 (1920), p. 94.

† 'Mysteries of the Libyan Desert' (London, 1925), p. 303.

	Latitude.	*Longitude.*
These differences reduced in the proportion of 5 to 7 become, in true degrees and minutes ..	7° 52′	8° 12′
The true position of Alexandria is	32° 12′	29° 53′
Whence the corrected position for the marshes in our modern system becomes	24° 20′	21° 41′

we get lat. 24° 20′ and long. 21° 41′ for the Tortoise Marshes. Comparing this position with that of Kufra, we find that the latitude agrees very closely with the 24° 14′ which Hassanein observed at Taj, the principal village of that oasis; while the longitude, though more than a degree and a half west of that of the principal village, is almost exactly correct for Taiserbo, the north-western oasis of the Kufra group.

Besides this remarkably close agreement as regards position, Kufra presents several natural features which would tend to support the view that it may be the locality which Ptolemy meant by the "Tortoise Marshes." Not only is Kufra an extensive tract of relatively low-lying ground with numerous lakes and salt-marshes of very considerable size, but it has distinctly the form of a valley. Hassanein Bey repeatedly refers to it as a valley in his description *; Mrs. Forbes also speaks of the "Wadi of Kufra," and mentions that as a result of a ride westward from Taj the "wadi" was found to have no definite ending to the west.† What more natural, therefore, than that some ancient traveller should have imagined that Kufra was a series of marshes formed by a river coming from the south-west? And is it not possible that Ptolemy, in endeavouring to piece together the scraps of information he could get, may have mistakenly inferred that this river ultimately reached the Mediterranean, and also have confused the account of it with those of other streams further south, which may have been branches of the Niger?

11. *The Sand-Dunes.*

The sand-dunes of the Libyan Desert have been the subject of careful studies by Mr. Beadnell and Mr. Harding King, and practically all that was known concerning them up to the outbreak of the Great War is contained in the excellent papers by them which were read and discussed at meetings of the Royal Geographical Society in 1910, 1916, and 1918.‡

With the commencement of the Senussi campaign in Egypt in 1915, the sand-dunes sprang into new and unexpected importance, from the fact that they formed one of the principal hindrances to the free movement of troops, and more especially of military motor transport, across the desert. Every line of dunes of any considerable extent had now to

* *Geogr. Journ.*, 43 (1924), p. 288.

† 'The Secret of the Sahara—Kufara' (London, 1921), p. 235.

‡ Beadnell, "The Sand-dunes of the Libyan Desert," *Geogr. Journ.* **25** (1910), pp. 379–395; Harding King, "The Nature and Formation of Sand Ripples and Dunes," *Geogr. Journ.*, **47** (1916), pp. 189–209; Harding King, "Study of a Dune Belt," *Geogr. Journ.*, **51** (1918), pp. 16–33, and Discussion, pp. 250–258.

be carefully mapped and examined for possible car-passages through it; the result was to add greatly to our knowledge of the distribution and extent of these remarkable features of the Libyan Desert, especially in the northern parts, where many long lines of dunes were found of which the existence was previously unsuspected by geographers, though they are familiar landmarks to the Bedouin of the region, and all except the smallest bear Arabic names. After the cessation of hostilities, interest in the distribution of dunes was maintained, because of the increasing use of motor-cars in place of camels for transport across the desert; and this circumstance has recently led to light being thrown on the distribution of the dunes in those southern regions which lay outside the field of operations during the war.

It is rather curious to note that although the sand-dunes form the greatest obstacle to motor-cars in the desert, yet it is chiefly by means of motor-cars that the true extent and distribution of the sand-dunes has been ascertained. Dunes are the most difficult of all desert features to map properly by ordinary reconnaissance methods with camel transport. Their smooth outlines provide no points on which intersections can be made, and no survey marks put on them will remain in place for more than a few hours, or at most a few days; they occur mostly in nearly level country, where it is impossible to find a station whence they can be overlooked; the absence of shadows on them renders it impossible to say whether one is looking at a single line of dunes, or at several lines, miles apart, one behind the other in echelon. The only sure way of mapping dunes is to traverse their sides along their entire length, and this is impracticable with camels owing to the enormous distances which would have to be covered without water. But with motor-cars one can run alongside them at 40 kilometres an hour instead of the camel's 4, and their distribution can thus be rapidly and easily ascertained.

On the map I have shown the distribution of sand-dunes as far as it is known at the present day. A comparison of this latest map with that given by Mr. Beadnell in his paper of 1910 will show how large is the number of dunes discovered and mapped in more recent years; and it will be noticed how pronounced is the constancy of the general direction of all the lines in the Egyptian portion of the Libyan Desert. Though no new lines of dunes comparable in extent with the great Abu Moharik belt have been added to the map, some of the newly discovered lines are of very considerable length, and they show an even more remarkable ratio of length to breadth than the Abu Moharik belt; the Ramak dunes, for instance, extend from near Moghara south-south-eastwards in a straight line for more than 100 kilometres, with only a single small break, and their width nowhere exceeds 1 kilometre. Moreover, the linear arrangement in a direction from about 20° west of north to about 20° east of south is even more pronounced in the newly discovered northern dunes than it is in those previously known farther south. In the " great

Prince Kemal el Din's expedition of 1925 *leaving Bir Terfawi for the waterless journey of* 250 *miles to Owenat*

The well at Bir Terfawi in the palm clump

Jebel Owenat from the south: the triple peak (5635 *feet*) *in centre*

The lake at Merga located by Prince Kemal el Din's expedition of 1925

sand sea " of Rohlfs, to the west of Dakhla and Farafra, the same directional arrangement of the individual lines of dunes is very noticeable, at least in the part near " Regenfeld " where I have penetrated it; and I found the same general direction to hold for most of the lines of dunes which I crossed on the way from Terfawi to Owenat. During the war I received a number of reports of dunes extending nearly east and west, often in curved lines; but investigations on the spot showed practically all these reports to be erroneous, the commonest mistake having been that of sighting different lines of dunes from different places under the impression that they were a single one.

The general south-south-easterly direction which is so marked a feature of the lines of dunes in the Egyptian portion of the Libyan Desert is not, however, preserved in the extreme south-west of the country. The line of dunes which crosses the Egypt–Sudan frontier in longitude 25° 40′ has a direction of about 30° *west* of south, and the dunes which extend from near Gebel Arkenu to the west of Gebel Owenat run about 38° west of south. From a point about 80 kilometres to the south-west of Gebel Owenat, the dune-lines make a still further distinct bend to the west, changing their direction by some 20° to about 58° west of south, and this latter direction is maintained by the dunes in the neighbourhood of Sarra Well.* According to the maps of Rohlfs and Mrs. Forbes, the dunes in the sandy tract to the north-west of Kufra follow approximately the same bearing as those near Sarra. The suggestion has been made that this swinging round of the direction of the dunes in the south-western part of the Libyan Desert may be due to a deflection of the prevailing wind by the mountain-masses. It is almost certainly caused by differences in the prevailing winds—in fact, the dune-lines probably afford a very exact index to the general wind-direction in the areas where they occur—but I am inclined to think that the regional distribution of atmospheric pressure, rather than local deflection by mountain masses, is the cause of the differences of wind-direction. The dunes, especially those near Sarra and Kufra, extend into localities which seem to me to be too distant from the mountains for the influence of the latter on the prevailing winds to afford a satisfactory explanation.†

In certain areas, especially in the south, as for instance on the Arbain road from Kharga to Sheb, around Pottery Hill, and in the region between Owenat and Erdi, there are sand-covered tracts which can

* For particulars of the distribution and directions of the dune-lines near Gebel Owenat, and between that mountain and Sarra, I am indebted to Prince Kemal el Din Hussein, who devoted special attention to observing them on his expedition to Sarra in 1926.

† It may be remarked that in the desert of Northern Sinai the dune-lines follow curved directions, instead of maintaining a single direction as in the Egyptian Libyan Desert, and this curvature of the Sinai dune-lines has generally been thought to be caused by the deflecting influence of the mountain masses of Moghara, Yelleg, and Hellal on the wind; but here also there may be regional influences at work.

The lake at Merga located by Prince Kemal el Din's expedition of 1925

hardly be mapped as dunes, because there are no very marked crests. These tracts are easily crossed by camels, but give much trouble with cars, and would probably be classed as dunes by car-drivers; but they are really only vast undulating fields of drifted sand. On the old Darb el Arbain slave road between Kharga and Sheb, one travels for more than 100 miles over drifts of this kind. No footprint of camel marks the track, footprints being obliterated in an hour or two. But one is never in doubt about the way, for it is indicated by the skeletons of countless camels which have perished on the weary march.

As regards the relation between dunes and the relief of the ground, there is a gradual rise in the general level of the country from north to south of about 1 in 1000, so that the southern ends of most of the Egyptian lines of dunes lie at higher altitudes than the northern ends; but I am fairly certain that this slight general inclination has nothing to do with dune-formation. The straightest and cleanest-cut lines of dunes are found in the flattest and most open parts of the desert, over which the wind can sweep without obstruction. When a line of dunes encounters in its southward progression a sudden fall in the ground-level, as for instance at the north end of Kharga Oasis and to the east of Pottery Hill, it usually breaks up; sometimes, as in Kharga, to resume its course as dunes in more open formation, and at other times, as near Pottery Hill, to spread out into a rolling plain of drifted sand. It is not uncommon for the south end of a line of dunes to split up, even on level ground, and the same can be seen, though less often, at the northern ends; but this is probably merely because the dunes are lower near the ends of the lines, and the width of the individual dunes is consequently less.

The great lines of dunes are probably extending southwards at a very slow rate, under the action of the prevailing wind. In this connection it is interesting to note that Arabs always speak of the south end of a line of dunes as its head, and of the north end as its tail; just the opposite of what one would instinctively call them from merely looking at the map, but correct if the dunes are known to have a southward progression. Mr. Beadnell found the average rate of progression of isolated small dunes in Kharga to be 15 metres per annum; but he remarks that large dunes move more slowly than small ones, owing to the greater mass of material to be transported. It is interesting to make a rough guess at the antiquity of the dunes from the length of certain of the longer lines and an estimated rate of progression. The Abu Moharik belt, for instance, has a total length of about 350 kilometres; hence, if its tail has remained stationary and its head has advanced southwards at an average rate of 10 metres a year, some 35,000 years must have been occupied in its formation.

As regards the height of the dunes, the only one I have carefully measured is that close west of Rohlfs' camp at Regenfeld, which I found to be exactly 30 metres. Some of the dunes in the Abu Moharik and

Ramak belts are considerably higher; but I doubt if any of the Libyan dunes rise much over 50 metres above ground-level, except in the "great sand sea" which commences some 14 kilometres to the north-west of Regenfeld, where Jordan estimated them to attain 100 metres or more.* The top of a high dune to the south of Melfa Oasis was found by triangulation to be 172 metres above sea; the level of the ground at its foot is unknown, but is probably not very much above the sea-level, so that Jordan's estimate of the height of some of the dunes in the "sand sea" is probably by no means an exaggerated one.

Much has been written about eddies in connection with dune-formation. The only observations I have made in this connection have been when endeavouring to place temporary marks on dunes to form survey-points; and the observations seem to show that if eddies are artificially created at the top of a dune, a rapid lowering of the dune-crest results. At first I used to thrust a walking-stick or ranging-rod some 2 or 3 feet into the dune-crest. The stick or rod, though quite firmly fixed at first, was always found after a few hours lying halfway down the dune-slope. The same thing happened with tripods firmly pressed down into the crest. When I was carrying out a little triangulation to determine the position of Rohlfs' cairn at Regenfeld in 1924, I had occasion to place a mark on a high dune, and I used an empty 4-gallon petrol tin filled with sand, bedding it well into the dune; but the next day it had disappeared from the crest, and was found, as the other things had been, halfway down the slope. These observations remind me of Mr. Barclay's description of the method of dealing with sand-accumulations in the Peruvian Desert,† where, as soon as dunes appear and threaten to obstruct a railway, the local inhabitants turn out and scatter pebbles and stones on the dunes, and very soon the dunes are gone, having been carried away owing to eddies produced by the wind around the stones. This device for removing incipient dunes might, I think, be tried along the Kharga Railway, where the screens put up at Mr. Harding King's suggestion have not been entirely successful in preventing the encroachment of sand on the line. I am the more disposed to think an experiment of this kind might succeed, because I have noticed that at the gap in the Ramak dunes (discovered by Col. Partridge and known during the war as "Partridge Gap") there are great lumps of silicified wood, which may have led to the gap being formed.

There are two other physical characteristics of dunes which I do not remember having seen mentioned. One of these is their low thermal conductivity. On a hot day, one has only to thrust one's hand a few inches into a dune to encounter cool sand, while on a bitterly cold day one can warm one's hands by the same action; thus while the diurnal

* See Jordan's notes on pp. 204 and 208 of his 'Physische Geographie und Meteorologie der libyschen Wüste," Cassel, 1876.

† *Geogr. Journ.*, 49 (1917), p. 55.

variation of temperature of the surface of a dune is frequently very great, it is almost insensible at quite a shallow depth in the interior. It follows that diurnal expansion and contraction of the grains composing the dune must be confined to the superficial layers, and the movements thereby caused may materially assist in consolidating the dune, by causing a " packing " of the grains. The other characteristic I have noticed is that the surfaces of the dunes always appear to be harder underfoot in the cool of the early morning than in the heat of the day. This may, of course, be an illusion owing to one's being less sensitive to fatigue in the early morning, when one's body has been refreshed by sleep, and when the air-temperature is comfortable ; but I have often fancied there is more in it than that, and it may easily be that the " packing " which has taken place owing to the considerable fall of temperature in the night, to say nothing of the action of dew, may have caused a real compacting of the surface layers.

In his paper of 1910, Mr. Beadnell considered that the sand composing the dunes must be derived from arenaceous formations to the north, and he made special mention of the need for a careful survey of the region in which the dunes originate. A reference to the map will show how correct was Mr. Beadnell's surmise, at least in the case of the Egyptian dunes which he had studied. The dunes originate in the great depressions which stretch from Siwa to the Wadi Natrun, where, as Mr. Beadnell inferred, the supply of arenaceous material from the loosely compacted Miocene and Oligocene beds is almost inexhaustible. We have here one of the clearest possible examples of the powerful action of the wind as an excavating and transporting agent. The Qattara depression has been excavated, largely by the wind, to a depth of over 130 metres below sea-level, and the excavated material has been carried southwards, some of it for nearly 1000 kilometres in distance and more than 500 metres in height, to form the dunes. We see not only the excavated hollow, but also the transported and piled-up arenaceous material removed from it; and the total quantity of rock thus removed and re-deposited must amount to hundreds of cubic kilometres.*

It is noticeable, however, that to the north of the " great sand sea " of Rohlfs, which extends for an unknown distance westward, the known depressions are much shallower ; and yet the total quantity of sand in this region is probably greater than that of all the more easterly dunes put together. The country between Jarabub and Jalo is however

* The steep Miocene escarpment, some 200 metres high, which bounds the Qattara depression on the north, probably produces a great eddy in the wind sweeping southwards over it, causing a whirl round a horizontal axis south of the scarp ; this may be very influential both in excavation and in lifting the sand to great heights. As a large portion of the floor of the depression at the foot of the escarpment is formed of a salty sludge (sabakha), it is likely that a considerable quantity of finely divided salt crystals are carried up with the sand in summer, and this may conceivably act to some extent as a binding material in the dunes.

almost unexplored, though it is known to be very sandy and to be the theatre of violent sandstorms. Whether similar deep depressions to that of Qattara have been excavated along, or to the north of, the Jarabub–Jalo road, or whether the area of loosely compacted arenaceous rocks exposed there is so enormous as to have yielded such a quantity of sand without any very deep depressions being formed, is a point that can only be cleared up by further exploration in Cyrenaica.

We now come to the most puzzling of all the questions connected with the sand-dunes, namely, why do they persist as sharply defined long narrow lines in certain places, while the ground elsewhere is almost absolutely free from sand? As Mr. Harding King puts it, the dunes appear to have a curious power of collecting all the sand in the neighbourhood.* The sheltering effect of ripples in the dunes, and a "shepherding" effect of winds a point or two off the normal, have been suggested as possibly affording some explanation of this apparent collecting-power,† but neither of these suggestions appears to be adequate. I think a more direct explanation is possible; namely, that the dunes really *have* the power of attracting sand from the air, and that this power is due to the well-known law of attraction between a conducting surface at zero potential and an electrically charged body. That air-borne sand-grains in the neighbourhood of a dune may carry electric charges was shown by Mr. Harding King's experiments, recorded in his paper of 1916, and I have since found sand-grains to carry electric charges of high voltage during sandstorms in Cairo. As to how the grains become charged with electricity, it can hardly be due to friction against each other, for the sand is remarkably uniform in composition, consisting generally of rounded grains of almost pure silica coated with a thin translucent film of ferric oxide,‡ and for the production of frictional electricity it is generally regarded as necessary that the two bodies which are rubbed together should be of dissimilar materials; § nor is it likely that they are

* *Geogr. Journ.*, 47 (1916), p. 209.

† *Geogr. Journ.*, 51 (1918), p. 252.

‡ Many years ago I discovered that this film can be removed by treating the sand with warm hydrochloric acid, leaving the grains of snowy whiteness (see my 'Description of the First or Aswan Cataract' (Cairo, 1907), p. 57). But I think traces of iron in the ferrous state must exist even within the white siliceous body of the grains, and be continually passing into the ferric state at the exposed surface; for otherwise it is difficult to account for the persistence of the yellow colour in spite of the mutual rubbing of the grains during their transport by wind. The film may possibly have an influence on the electrical behaviour of the grains, by reason of its possessing a higher conductivity than the silica of the interior.

§ Professor P. E. Shaw has quite recently (*Nature*, vol. **118** (1926), p. 659) suggested from laboratory experiments that the mutual *impact* of particles of *identical* nature in sandstorms may result in electrification of the particles and of the air with charges of opposite signs. I think most travellers in the desert have, like myself, formed the impression that electrification of the air is more pronounced during sandstorms (khamsins) than at other times. But it is curious that observations made with the electrograph at Helwan Observatory do not seem altogether to bear this out. Dr.

electrified by friction with the air, for they travel with it. But if the particles are carried into an upper air-stratum, they will gradually acquire its potential by conduction; and the ordinary potential gradient in the air in Egypt is over 100 volts per metre of height.* Hence a sand-particle carried along for some time in the air at a height of only 20 metres above the ground may become charged to 7 electro-static units of potential, or 2100 volts; and on approaching a dune rising to about that height it will be attracted to the dune, which being in connection with the earth is at zero potential. The attraction will be very small unless the sand-grain approaches very closely to the surface of the dune; from some calculations I have made, a spherical grain of silica half a millimetre in diameter charged to a potential of 2100 volts will not be attracted with a force equal to half its own weight until it approaches within a centimetre of the conducting surface, and the grain will have to approach within 7 millimetres of the surface before the attraction is equal to the weight of the grain. But the important thing to note is that the attraction is independent both of the sign of the charge and of the direction of the wind which carries the particle. Another way of looking at the matter is to consider the probable distribution of the equipotential surfaces in the air about a dune, as in the diagram below, which represents a section taken perpendicular to the direction of the wind and to the axis of the line of dunes:

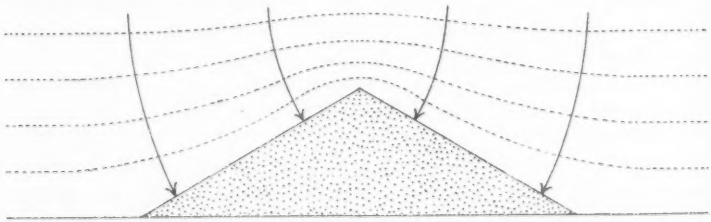


Diagram showing suggested distribution of equipotential surfaces and directions of lines of force in the neighbourhood of a sand-dune

The equipotential surfaces, shown by dotted lines, will be squeezed together over the dune, and the electric forces, shown by full lines and arrows, being everywhere normal to those surfaces, will converge to the dune. Thus the dune will attract any particles carried by the wind and charged by conduction to the potential of the air conveying them. If the wind changes its direction, the attraction will still persist unaltered. Another point worth mention is that a sand-dune may be far more effective in its attraction of sand than a rocky ridge of the same size and shape

Hurst finds that khamsins are usually accompanied by low values of potential gradient in their early stages, with great disturbances both positive and negative for some hours before and after the break of the khamsin ('Observations on Atmospheric Electricity at Helwan Observatory,' Survey Dept. Paper No. 10 (Cairo, 1909), pp. 52–62).

* Hurst, *op. cit.*, p. 28.

would be; for when the electrified grains approach the surface of the dune, uncharged grains can rise from the dune to meet them; possibly some of the dancing of sand-grains which is frequently observable along the crest of a dune during a wind may be due to this cause.* During violent sandstorms, particles of sand may be whirled aloft and kept suspended at high altitudes for a period long enough for them to acquire very high potentials, and a sudden cessation of the storm may cause them to fall so rapidly that much of the charge may be retained; in which case, of course, electrical attraction may cause a very considerable deviation from the purely gravitational paths of the falling particles, the deviation being always towards the dune. Since the closeness of the equipotential surfaces and the mobility of the sand-grains composing the dune are greatest along the dune-crest, the maximum rate of deposition will be at the top of the dune, which is also the place where the wind exerts its greatest action in conveying the sand of the dunes southward. That the long axes of the lines of dunes do really correspond with the direction of the prevailing wind is certain, both from Mr. Beadnell's observations of wind-direction † and from the fact that the scoring of the limestones in the Libyan Desert by wind-borne sand coincides in direction with the lines of dunes.‡ Thus I suggest that while the extension of the lines of dunes southwards is purely the result of the prevailing north-north-west wind, their clean-cut character and narrow width is the consequence of lateral attraction by the dunes themselves on the flying electrified particles of sand.

If the hypothesis I have ventured to put forward is regarded as likely to furnish the true explanation for the formation of the lines of dunes, I hope that someone possessing the necessary skill in electrostatic measurement will put it to a crucial test, by carrying out observations on and near the dunes themselves. If a number of flying sand-grains could be caught from different levels in an insulated metallic receiver connected to an electrometer, the readings of the electrometer would enable the potentials to which the grains were charged at different levels to be calculated, provided the electrostatic capacity of the receiving system and the number and diameter of the grains giving up their charge

* Mr. Harding King records in his paper of 1915 that he found sand-grains blown *off* the dunes to be electrified; can these have been grains which became charged by jumping up from the dune to meet others and thus sharing their charge?

† *Geogr. Journ.*, 35 (1910), p. 385.

‡ The hot and disagreeable south and south-west winds which blow during the "khamsins" of the spring are much less constant in their direction; and though they produce thick sandstorms, they have always seemed to me to occasion rather a general scattering of the sand over the surface of the desert than to form deposits having very definite arrangement; moreover, they blow on relatively few days of the year. The far more prevalent cool strong north-north-west winds, on the other hand, often scarcely vary a point in direction for days together, and their coincidence with the direction of the dune-lines is very pronounced.

were measured. Allowance would, of course, have to be made for any electrification of the receiver by the air, or by uncaught sand-grains, as well as for losses by imperfect insulation of the collecting system. In a preliminary experiment of this kind which I made in Cairo during a sandstorm, leakage from the electrometer was found to be so great as to vitiate any attempts at accurate measurement; but I think this particular difficulty could be overcome with a specially designed apparatus, or that at least the leakage could be measured and allowed for. The taking of observations of any kind in dune areas during windy weather is a most difficult and trying operation, and commonly means, in addition, a sojourn of some weeks in isolated and otherwise uninteresting areas. But the advent of the motor-car has so greatly facilitated communication in the deserts that difficulties of access are now not so great as they used to be; the south end of the 35-kilometre line of the Kattania Dunes, for instance, about 90 kilometres west-south-west of Cairo, which would form an excellent site for detailed observations, can now be reached by a four or five hours' car journey from Cairo instead of the several days' journey by camel which was formerly necessary.

12. *The Distribution of Stone Implements.*

I have not made any special study of stone implements, nor have I been able to pay any considerable attention to their collection during my journeys, having usually found my time very fully taken up with other matters. I have, however, been much struck by the wide distribution of stone implements in the desert. I have found them, for instance, not only in Siwa Oasis and near the wells of Abu Mungar and Sheb, but also on the plateau between Baharia and Farafra, on the open desert between Terfawi and Owenat, and to the south-west of Owenat near the Anglo-French boundary. This wide range of occurrence, coupled with the finds of Schweinfurth and others on the plateaux nearer the Nile, inclines me to think that there is scarcely any part of the Libyan Desert in which stone implements might not be found by an expedition which would make the collection and study of them one of its main objects. The likeliest places in which to search (besides the neighbourhood of old wells and springs) would appear to be the shores of the various lakes and around the feet of hills affording shelter from wind and sun; for it is in such localities that I have most usually come across implements and pottery. Grinding-stones, often with a sort of stone rolling-pin, unpolished celts, knives, and arrow-heads are the principal forms of implement I have met with. Many of the grinding-stones must have been carried for a considerable distance, for they are made out of rocks which do not naturally occur in the localities in which they are found.

Whether this wide distribution of stone implements would justify the view of Blanckhenhorn* that primitive man lived on the desert plateaux

* *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 1902, p. 760.

rather than in the Nile Valley must, I think, be settled by the further collection of specimens and by a careful comparison of the forms to be found in the two situations. In this connection I may remark that the grinding-stones I have seen in the desert seemed to me to be very similar to those used by the Nubians of the Nile Valley to-day for grinding corn.

APPENDIX

SOME RECENTLY DETERMINED POSITIONS IN THE LIBYAN DESERT

In view of their possible utility in connection with future exploratory surveys, I give below a list of some of the more important of the positions which I have recently determined by astronomical observation in the southern part of the Libyan Desert, with brief descriptive notes on the places to which they refer. The observations were made whilst accompanying H.R.H. Prince Kemal el Din Hussein on his exploratory motor-car expeditions of 1923, 1924, and 1925. The longitudes of Qasr Farafra, Abu Mungar, Pottery Hill, and Regenfeld depend on the transport of a box-chronometer; the others on wireless time-signals from Europe. The positions of peaks were found by triangulation from the actual observation-spots. The altitudes of camps are from careful barometric determinations; those of the peaks depend on trigonometric levelling from the camps.

Place.	*Lat. N.* ° ′ ″	*Long. E.* ° ′ ″	*Altitude above sea.* *Metres.*
Merga, Camp 600 metres S.W. of west corner of salt lake. (Lake surface is 17 metres below level of camp.)	19 2 29	26 18 32	526
Bir Terfawi, Camp close to well and palms ..	22 55 12	28 52 51	244
Gebel Kissu, Summit	21 34 59	25 8 26	1726
Gebel Owenat, highest point	21 54 34	25 0 47	1907
„ „ remarkable triple peak ..	21 53 51	25 1 39	1718
„ „ S.W. peak	21 49 35	24 53 52	1450
Chunk Hill, Summit	21 52 46	25 13 56	985
Owenat, Camp 600 metres S.E. of western spring, on plain at foot of mountain	21 48 35	24 51 45	568
Owenat, Camp at mouth of gully, about 800 metres S.S.E. of eastern springs	21 53 8	25 7 58	626
Gebel Kamil, Summit (160 metres above plain)..	22 16 31	26 38 11	800
Regenfeld, Rohlfs' cairn of 1874, rediscovered 1924	25 10 49	27 24 22	470
Pottery Hill, Summit (39 metres above plain) ..	24 26 27	27 38 54	506
Sheb, Camp close to well, 240 metres N.N.E. of fort	22 19 48	29 45 46	228
Mut, Government Rest-house	25 28 37	28 58 24	119
Abu Mungar, Camp at small ruin, 400 metres E.S.E. of well	26 30 22	27 35 29	117
Qasr Farafra, Camp E. of village, 200 metres S.W. of Tomb of Sheikh Dakhil	27 3 26	27 57 52	90

Merga.—To geographers the most important of the new determinations will undoubtedly be that of the uninhabited oasis of Merga, which had not previously been visited by a European, and of which the situation could hitherto only be guessed at from Arab statements. Merga lies in a shallow depression about 50 metres deep, broken by sandstone hills and sand-dunes, and extending

for some 20 kilometres north-east and south-west. The salt-lake, near the centre of the depression, measures about 300 metres by 150. It is surrounded by tall rushes and sandhills except at its south-western end. There are numerous date-palms, both near the lake and at considerable distances from it, as well as acacia trees and tamarisk bushes. The neighbourhood of the lake swarms with mosquitoes. Good and plentiful water was got by shallow digging about 1 kilometre south-south-east of the observation-spot, and could probably be obtained by digging almost anywhere in the depression. It is possible that the names Bidi and Tura el Bedai, shown with a question mark on some Sudan maps, may refer to different spots within the same depression. Owing to the plentifully scattered vegetation, the place cannot easily be missed, either by travellers passing within several miles of the lake, or by aircraft; but the landing of aeroplanes in the neighbourhood of the lake might be difficult owing to the extensive sand-drifts.

Bir Terfawi.—Scarcely less important than the accurate fixation of Merga is that of Bir Terfawi, the farthest south-west of all the Egyptian artesian water-sources hitherto known. It will be remarked that this latest determination places the well some 22′ south and 15′ east of the position which I had provisionally assigned to it from the rough data furnished by Lieut. Moore's traverse of 1916.* A knowledge of the true position of Terfawi is specially desirable for a traveller who wishes to reach it, owing to the absence of any conspicuous landmark near it and to the sandy nature of the surrounding country, which causes tracks to be soon obliterated. There are numerous sandhills covered with tamarisk bushes around Terfawi, and a little grazing for camels. Besides the well at which observations were taken, water was found by digging in the sand at the foot of some tamarisk mounds about 13 kilometres farther west, and it is probable that good and plentiful supplies could be obtained at shallow depths near any of the other mounds. The palm-trees at Terfawi are few and small, and are less conspicuous than the tamarisk-bushes. These latter should enable the place to be easily found by aircraft; but landing would require some caution owing to the prevalence of drifted sand.

Gebels Kissu and Owenat.—The peaks of these mountains (especially that of Kissu, because of its isolated character and sharply marked summit) will form useful points for the connection of future surveys, being visible from very long distances.

Chunk Hill is a prominent isolated hill, nearly conical and of dark colour, which forms a good landmark in the broken country to the east of Gebel Owenat. It rises some 335 metres above the ground at its foot.

The Springs of Owenat.—Of the two water-sources of Owenat whose positions are given, the western one is the better, and is moreover very easy of access, being practically on the level of the plain which extends southwards from the mountain mass, and easily discoverable by the numerous animal-tracks converging to it; it is a pool among great boulders, obviously fed by percolation through cracks and fissures in the granite mountain which towers above it. The eastern water-source is less easy of access; it lies about 1 kilometre up a stony gully, and consists of a series of pools in the rocky floor of the gully, fed by trickling springs at the level where the granite is overlain by sandstone. The plain to the south of the western spring would form an excellent landing-ground for aircraft.

Whilst in the neighbourhood of Owenat, I had hoped to re-determine the

* 'Recent Determinations of Geographical Positions in the Libyan Desert,' Survey Department Paper No. 34, 1919, p. 14.

longitude of Hassanein Bey's camp of 1923 with the aid of wireless time-signals, or at least by triangulation-connection to one of my observation-points, because a really accurate fixation of the longitude of a point about midway along his route from Jarabub to Furawia would possibly furnish the means of slightly correcting the longitudes assigned to Hassanein's camps at Kufra and Erdi. I was unfortunately prevented from carrying out the desired connection; but from a hurried car-traverse which I made, skirting the western side of the mountain mass, in the course of which I must have passed pretty close to the site of Hassanein's Owenat camp, I think that camp really lies about in longitude 24° 49′, or some 5 miles to the west of where I had previously calculated it to be from Hassanein's traverse data; * and that in consequence the longitudes assigned to Kufra and Erdi from the same data may be some 2 or 3 miles too great.

Gebel Kamil is a sharply pointed hill of dark sandstone, forming a useful landmark between Terfawi and Owenat. It was visible from the east for more than 40, or from the west for about 20, kilometres. The name was given to it by Prince Kemal el Din in honour of his father, Hussein Kamil, the late Sultan of Egypt.

Regenfeld, it will be remarked, was found to be very nearly in the position assigned to it by Jordan in 1876,† and my estimation of the level of the place is only 20 metres higher than Jordan's. The neighbouring dune I found to be 30 metres high, agreeing exactly with Jordan's measurement of fifty years previously; and as far as I could judge, the situation of the dune relative to the cairn seems to have remained unchanged through this long interval, showing that there has been at any rate no great lateral displacement of the dunes. The iron tanks left by Rohlfs were quite intact, in spite of their half-century of exposure; they had become covered with a hard dark brown film, apparently of magnetic oxide of iron, not rusted in the ordinary way, a fact which speaks strongly for the dryness of the region. Empty wine-bottles left by the Rohlfs expedition were frosted by the sand-blast wherever they were exposed; but surprisingly little of the glass had been removed in this way.

Pottery Hill is the northern one of a pair of nearly conical dark sandstone hills about 40 metres high, which are conspicuous from some distance owing to their situation on a nearly level sand-plain. I gave it its name from the numerous jars which I discovered at its foot in 1917.

Sheb Well is a pool of fairly good water in a shallow excavation at the foot of a clump of dom palms, half surrounded by sand-dunes and tamarisk mounds, 240 metres north-north-west of a fort; the latter occupies a fairly conspicuous position on a sandstone hill about 25 metres high. Another well, situated at the foot of a clump of dom palms about 11 kilometres farther north, is called Bir Terfau; this should not, of course, be confused with the Bir Terfawi already mentioned.

To the north of Sheb, on the Arbain road, are three other water-sources which I visited in 1925 and of which I determined the approximate positions by a carefully controlled car-traverse: Bir Kassaba, in lat. 22° 41′, long. 29° 55′; Bir Abu Hussein, in lat. 22° 53′, long. 29° 55′; and Bir Murr, in lat. 23° 22′, long. 30° 5′. Bir Kassaba is a pool of good water at the foot of a clump of

* *Geogr. Journ.*, 44 (1924), p. 377.

† Jordan's final position was lat. 25° 11′ 7″, long. 27° 25′ 0″. The longitude given on the document found in the bottle at the cairn (14° 42′ E. of Berlin, or 28° 3′ 42″ E. of Greenwich) was a preliminary value resulting from Jordan's observation of a lunar distance, and was wrong by some 40 miles.

palms; Bir Abu Hussein, which likewise yields good water, is a small excavation in sand near a hill of pink coarse-grained granite, and usually requires to be dug out afresh by each traveller; Bir Murr, on a little plain surrounded by hills, consists of several holes, with fairly good water, excavated in the sand at the south side of the outcrop of a steeply inclined bed of speckled calcareous sandstone.

I have not myself traversed the desert to the east of Sheb, but according to an intelligent Arab who has recently made the journey from Sheb to Dungul, there are only two spots between these places at which water is obtainable; they are Bir Abu Seifa, a small well of good water about 50 kilometres from Sheb, and Bir Haleifa, about 15 kilometres farther on, where there is a fort and numerous wells. This latter place must, I think, be the same as the Bir Nakhlai, of which the position found astronomically by Colonel Talbot in 1893 was lat. 22° 29′ 1″, long. 30° 19′ 36″.

The Rest-house at Mut, in Dakhla Oasis, is a low whitewashed building of three rooms, situated on open ground a little to the south of the village. It is conspicuous by reason of its isolation from other buildings, and forms a convenient starting-point for car journeys to the south-west of Dakhla, as well as for journeys to Kharga by the southern track which was mostly followed by cars during the war.

Abu Mungar proved to be very close to the position given by Mr. Harding King's observations of 1912.* To the south-east of Abu Mungar, about halfway to Dakhla, are two remarkable hills forming outliers of the plateau. These hills, which are good landmarks, were first discovered by Mr. Harding King, and as they appear to possess no native name, I have called them "King's Hills" on the map. The farther one of the two from the plateau lies in lat. 25° 58′, long. 28° 11′, from compass-bearings which I took to it on a careful car-traverse in 1924. The other is about 2 kilometres farther north.

Qasr Farafra.—The position of the village of Qasr Farafra which I gave in my paper of 1919 † is proved to be very nearly correct by the latest observations. The main advantage of the new determination is that it is referred to an easily identifiable landmark, the tomb of Sheikh Dakhil, instead of to the ill-defined centre of the village.

Levels in or near Baharia Oasis.—I think it may be well to record here that owing to an unfortunate mistake about the datum to which the level of the old military railway-terminus at B6 was referred, all the altitudes given on pp. 10 and 11 of my above-mentioned Survey Department Paper of 1919 require a correction of 19 metres to be added. At the time when I triangulated Baharia in 1917, I was informed that the level found by the military authorities for the terminus was measured from the sea-level datum, and I employed the value given for it as my fundamental level. But I have since ascertained that an arbitrary datum was employed by the military engineers; and trigonometric levelling from the Nile Valley has shown that this arbitrary datum was about 19 metres above sea-level.

* Mr. Harding King's observations gave the latitude as 26° 30′ 46″, and the longitude as 27° 36′ (see his map in *Geogr. Journ.*, 42 (1913), p. 516).

† 'Recent Determinations of Positions in the Libyan Desert,' Survey Department Paper No. 34 (Cairo, 1919), p. 12.

THE CAMBRIDGE EXPEDITION TO EAST GREENLAND IN 1926

J. M. Wordie

Read at the Meeting of the Society, 21 March 1927. Map follows page 320.

Historical.

TO Henry Hudson is generally given the credit of the first definite record of land in East Greenland with the discovery of Hold with Hope in 1607. The coast farther south, however, must have been visited on many occasions by the early Norsemen on their way to the colonies on the west coast established by Eric the Red: there seems no doubt, for instance, that Gunbiørn's Skerries, mentioned in their early sailing directions, lay somewhere on the east coast. There is a romantic story also in the Floamanna saga of how Thorgils Örrabeinsfostri lost his ship in 1001 A.D., but finally reached the west coast between three and four years later. In passing one may remark that it is widely held in Denmark that the old, almost mythical name "Svalbard," which has recently been given to Spitsbergen, most probably denoted the Scoresby Sound region; others, however, would have it refer to Jan Mayen.

These early records were of course unknown to Hudson. He appears also to have reached the coast only by accident, and never returned to pursue his discoveries. The next records are those of a Dutch skipper, Gael Hamkes, in 1654, and of another, Broer Ruys, in 1655. The coast was probably familiar to whalers all through the eighteenth century, but their business did not permit of their following up the discovery of such land as they may have seen. There is no record of early whalers having actually landed; but William Scoresby, Junior, himself a whaler, was of the opinion that whale fishers might have been ashore.*

Scoresby's notable voyage was made in 1822 in the *Baffin* of Liverpool, and during part of the time he was in company with his father, William Scoresby, Senior, in the *Fame*. The son made his first landing at Cape Lister and Cape Swainson on July 24. The same day the father was searching for whales farther up the Sound, and his boats explored Hurry Inlet. Altogether the Scoresbys spent three days in the outer part of the Sound which now bears their name. A second landing was made later in the season (August 10) at Cape Moorsom on Traill Island. Scoresby snatched at every opportunity of charting his discoveries, and his finished map covers 5° of latitude: its accuracy is greatest in the southern portion along the Liverpool Coast, but north of Traill Island his distance from the land (never less than 30 to 40 miles) made it quite impossible to show the actual sea-coast. It is worth noting that this was the only year in which Scoresby landed on East Greenland, although he made twenty whaling voyages between 1803 and 1823.

* 'Journal of a Voyage to the Northern Whale Fishery,' p. 183.

The next year, 1823, Captain Clavering was commissioned to take H.M.S. *Griper* to the east coast to enable Captain Sabine, R.A., to swing the seconds pendulum in a high latitude. This voyage led to the discovery of the Pendulum Islands and much new land, some of which, however, had been previously sighted at a distance by Scoresby. The *Griper* lay at anchor for a month near the pendulum station, and during this time Clavering made a boat trip south-westwards to Gael Hamkes Bay, discovering Loch Fyne and other inlets.

Nearly fifty years later Sabine Island became the headquarters of the *Germania* expedition in 1869–70 under the leadership of Captain Koldewey. The latter's explorations were mainly to the northward, but shortly before returning home he discovered Franz Josef Fjord, and Lieut. Payer and Professor Copeland (ultimately Scots Astronomer Royal) climbed the 7000-feet Payer Peak; from here they reported a great pyramid far to the west, which they named Petermann Peak. Between that date and the Cambridge expedition the only other visit to inner Franz Josef Fjord is that of Professor Nathorst with a Swedish party in 1899. Three weeks were spent discovering new fjords and islands and completing a plane-table map of this large area. The result of this expedition was to make the interior fjords extremely well known, whereas the outer coast remained as in Scoresby's and Clavering's time. An attempt was made to remedy this with a Cambridge party in 1923: unfavourable ice led to narrow escape from disaster, however, and the voyage proved unsuccessful. The 1926 expedition was made in a larger ship, and enjoying most unusually favourable ice conditions was able to re-map almost all Clavering's and Scoresby's ground, and by further explorations complete the charting of the coast.

The Pendulum Islands.

Our ship, the *Heimland* of Tromsö, was a coal-burning sloop of 64 tons net, officered last summer by Lars Jakobsen, who is part owner, as captain, and by Bendix Johansen as mate; in addition the crew consisted of two engineers, four seamen, the cook, and the cook's mate. She met our party by arrangement at Aberdeen, took on board stores and *personnel* on June 28 and 29, and sailed the day following.

The Wardroom party numbered eight; Lieut. P. F. White and G. Manley had charge of the survey work, M. A. Barnett was wireless expert, and Dr. D. McI. Johnson had prepared himself for study of the Eskimo remains. Of the other members A. Courtauld and C. de Bunsen looked after the cameras, and J. H. Bell took charge of all camp equipment and stores. Throughout the summer it was a principle that those whose interests were general should as far as possible help the more highly trained members. This plan worked very well, and one must record the extraordinary enthusiasm displayed throughout the summer by all members of the party.

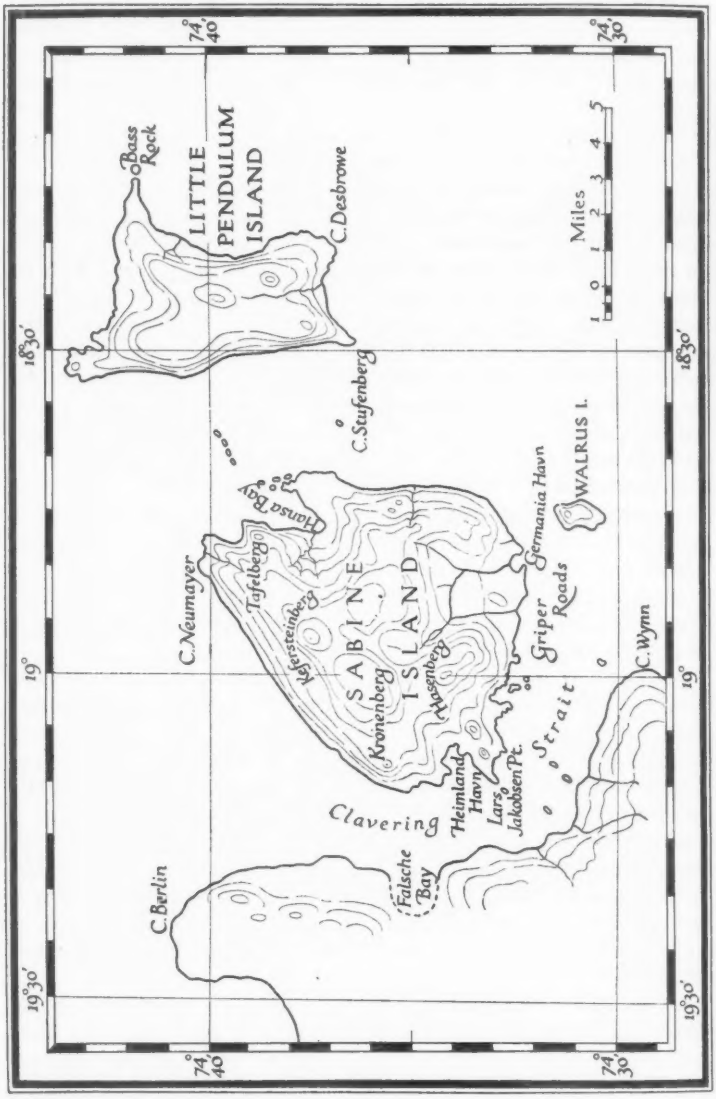
Taking the Fair Isle Passage, a course was set direct to Jan Mayen. In light airs and almost perfect weather we made a landfall five days later and anchored off the north-west coast. It had been our intention to land and visit the wireless station at Jameson Bay in order to make arrangements for transmitting our messages. This, however, was unnecessary, and in fact undesirable by reason of the thick fog which prevailed, indicating the near presence of the pack ice. Barnett soon got into wireless touch with the operators, and arranged for them to listen in both morning and evening.

Leaving Jan Mayen on July 6, a course was followed northwards along the pack edge to latitude 75° N. and the ice entered on July 8. The weather had been misty since leaving Jan Mayen, but the pack was of such open nature that we could follow a westerly course without much difficulty, and were forced to tie up only when the fog proved too thick, as it did on three occasions for about twenty-four hours altogether. Open water, the weather still being thick, was reached at 5 p.m. on July 11. Navigating sights had been taken with an artificial horizon in the pack, and allowance made for the southward current; we now steamed west across land water for 40 miles. In the late evening we reached landfast ice, and turning south followed it to a sheltered bight with anchorage in 8 fathoms, muddy bottom. We knew we were very close to land, but after the three days of fog had but a faint idea of where we actually lay. Next morning the mist rolled up like a curtain and revealed a hillside of terraced lavas of pleasantly brown colour. It was then seen that we were at anchor under the south side of Little Pendulum Island, in an anchorage in fact recommended in the *Arctic Pilot*, and no doubt first made known by Captain Clavering.

It was now possible to shape a definite programme of the summer's work. Previously one had hardly dared to be too explicit in one's plans, fearful of disappointment as in 1923; but now two facts stood out very clearly—these were the land water 40 miles in breadth, and the presence still, in the Griper Roads and between the Pendulum Islands, of a fair amount of landfast ice. The one foretold an open summer with opportunities of easy navigation along the coasts; the other implied that the season was still early for coastal work, and that the mouths of the big fjords, such as Franz Josef, might still be ice-encumbered. It was decided, therefore, to commence the pendulum experiments at once and to defer the exploratory survey until the season was a little more advanced.

The object of Captain Clavering's voyage was to enable Captain (afterwards General) Sabine to conduct pendulum experiments in a high latitude. Sabine spent one month at Inner Pendulum (now Sabine) Island, setting up his observatory on "the site of an Eskimaux village." The exact place where the instruments stood was not marked in any way; as there is only one Eskimo site, however, on this part of the coast,

Sabine's observatory is known to within about 100 yards. Fresh verification of Sabine's work had been considered desirable, and we had willingly



undertaken to carry out a second set of experiments. For this purpose the Science Museum, through the good offices of Sir Henry Lyons and

Hansa Bay and Tafelberg, Sabine Island

Head of Granta Fjord

Riddarborgen and mouth of Kjerulf Fjord

Cambridge Peaks from First Camp (3000 *feet*)

Plane-table party, Loch Fyne

Germania Berg and Germania Havn, Sabine Island

Head of Franz Josef Fjord

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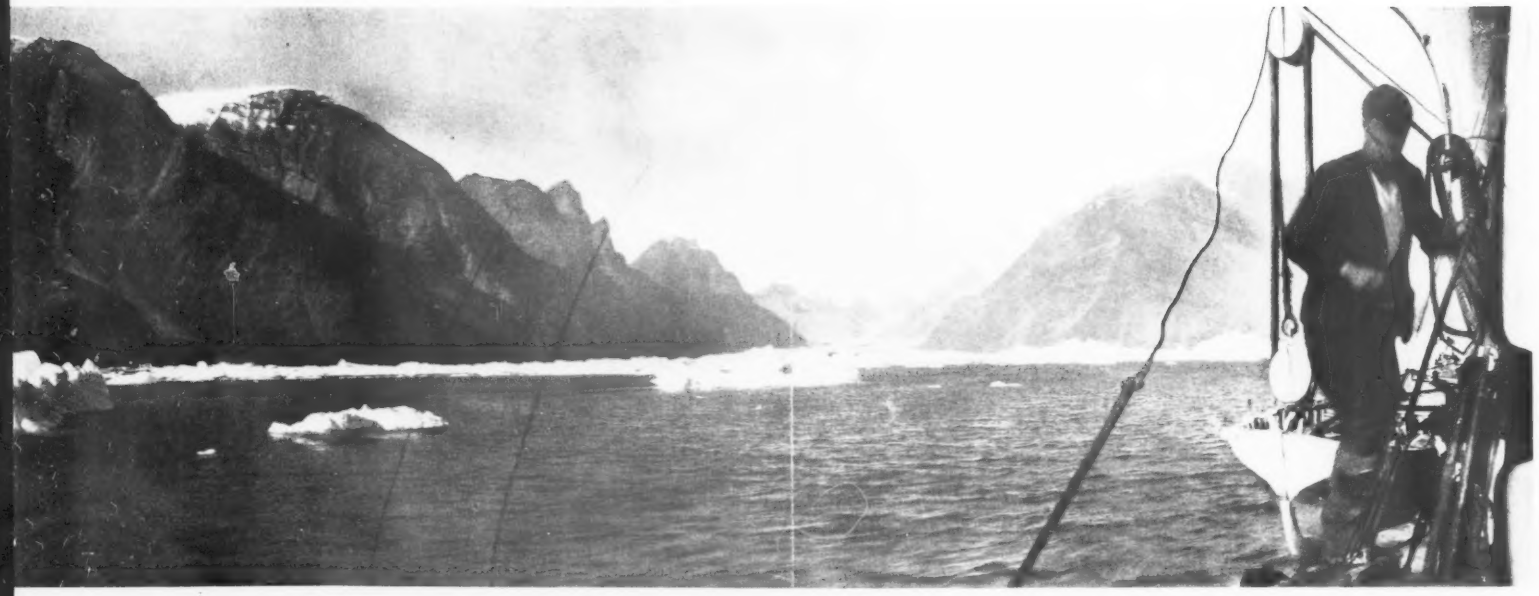
Petermann Peak as seen from Highest Cambridge Peak (7670 feet)

Kjerulf Fjord, Riddarborgen, and Nordenskiöld Glacier, Franz Josef Fjord

ann Peak as seen from Highest Cambridge Peak (7670 feet)



ord, Riddarborgen, and Nordenskiöld Glacier, Franz Josef Fjord

Sir G. Lenox-Conyngham, lent the apparatus previously taken to the Antarctic by Captain Scott, and a generous grant to cover expenses was made by the Royal Society. A further attraction of a stay at Sabine Island was the possibility of taking a definitive series of longitude determinations and settling the question of whether Greenland has moved westwards, as claimed by Dr. Wegener. A reconnaissance party was landed near Germania Havn late on July 12, and a site selected for the observatory on the eastern promontory of the harbour. The German Observatory in 1869–70 was on the western promontory, and Sabine's a little north-west from there. We were constrained to choose a new position by the presence of fast-ice farther west; and an added advantage was a fair-sized hut built by the short-lived Danish East Greenland Company in 1919.* Manley conducted his experiments in two Whymper tents placed end to end, living meanwhile with a companion on higher ground in smaller Mummery tents. It was expected that the work would occupy about six days; in the interval the rest of the party were to make Sabine Island their nursery ground for picking up camp methods, acquiring a knowledge of the best means of land travel, and estimating the rate at which future surveys could be made.

A map of Sabine Island had already been made by Copeland and Börgen during the *Germania* Expedition, and appears in the German, but not the English, account of the voyage. Our parties only made some slight alterations in detail, particularly at the north end. The island is almost exclusively of volcanic origin, and may be compared, so far as hill outlines are concerned, with the terraced Tertiary volcanic region in the north and west of Skye. It may be noted in passing that the terraced features and prominent scarps are seldom the actual lava-flows, but generally massive horizontal sheets or sills of igneous magma injected along the centre of the flows after the latter had partly cooled. These sheets cover a much wider area than the lavas, and may be traced far west on the mainland. No definite volcanic centre was discovered; that the focus of activity was not far distant was indicated by the occurrence of thick masses of volcanic ash on the Hasenberg. Near the summit of that mountain Bell made a further discovery of interest by finding fossil tree-trunks in the ash: these had all the appearance of being charred and scorched, and led us to the belief that the hot ashes in their descent had smothered and destroyed the Tertiary forest growth. The presence of these trees is but one more instance of the temperate conditions and rich vegetation in the Arctic in older geological periods. To-day the vegetation of the island is barren in the extreme, resembling that of Jan Mayen. Later we were to find a more luxuriant growth on the mainland; here, however, the but slightly weathered volcanic *débris* had served to drain away all moisture, and the opportunities of plant growth were extremely meagre.

* K. R. Dahl, 'The *Teddy* Expedition.' London: 1925.

It became evident that Manley's work was taking longer than originally expected. This gave an opportunity, however, to take the ship up Clavering Straits to Cape Berlin, and also to visit the Bass Rock. During these days almost all the fast-ice had broken out, and it would have been possible to sail the ship even behind Kuhn Island. The sight of open water in this region made it very clear that 1926 was a more than usually open season. Several landings were made in Clavering Straits, and one party was able to reach the top of the Hühnerberg, a major point in the German survey. It may be of interest to note that Courtauld on July 21 found a record left on the summit by Professor Copeland on the same day and month fifty-six years earlier. Ice was still blocking the north side of Sabine Island, and in order to reach the Bass Rock it was necessary to go round by the south. The hut built at the Bass Rock for the Baldwin-Ziegler Expedition in 1901 and later lived in by Captain Einar Mikkelsen in 1912, is still in good repair; a motor boat with sails was also left here in 1923. The place, however, can hardly be considered a good wintering site, and is now very ill provisioned. Parties in distress should avail themselves of the first-rate Danish hut at Germania Havn. While returning to pick up Manley a north-north-east gale broke on July 23 and blew without abatement for three days. We had good holding ground at Cape Desbrowe, and our main anxiety was for the pendulum party. Their experience was by no means pleasant, and but for the shelter of the hut might well have been much worse. Manley's work was fortunately finished before the gale came on: he reported unexpected good fortune throughout the observations in the presence of daily coast fogs which acted as a blanket and kept the temperature uniform during the readings. On the other hand, he seldom saw the sun, and his total of longitude sights is hardly enough to be decisive in regard to longitude. The pendulum apparatus was brought on board on July 26, and a course then set for Gael Hamkes Bay.

Gael Hamkes Bay.

It may be recalled that while Sabine was conducting his pendulum experiments Clavering took the opportunity of making an expedition in one of the ship's boats to the south and west. In a period of twelve days he explored and mapped Gael Hamkes Bay, rowed to the head of Loch Fyne, climbed Jordanhill and had the good fortune to meet a company of twelve Eskimo. This encounter, on the south side of Clavering Island, is the only occasion on which living Eskimo have been met with north of Angmagsalik. The time at our disposal was somewhat less than Clavering's, but with more rapid means of transit and division into two parties we were able to extend and complete his map. We entered the bay with high hopes. The charts as they stood showed two tempting openings west of Jordanhill; either of these might open out into reaches comparable perhaps to Franz Josef Fjord. We had also

before us the prospect of the old Eskimo villages. The hopes of an extensive and new fjord system were soon dispelled; Jordanhill stands sentinel at the foot of a great and broad glacier. In fact, we soon found that Clavering's map was of an accuracy which left little room for improvement. That the Jordanhill glacier appeared as open water on charts was due to later misinterpretation, or possibly to a failure at the time to understand the true nature of land and sea ice.

We first reached new ground at the west end of Clavering Island: from high up on the mountains White detected inconsistencies on the German map of 1869, more especially where their route round the north side of the island was supposed to connect with Clavering's round the south. This led to the discovery of a new inlet—Granta Fjord—midway between Tiroler Fjord and Jordanhill. We made the journey to its head on foot, access for the ship being barred by shallows near the mouth. It proved a region of great beauty, the mountains in the outer part descending steeply to the shores of the fjord, but receding again near the head to form a wide terraced valley which led due west to the great Jordanhill Glacier. While the main party was in Granta Fjord a second party under Barnett camped on the east side of Loch Fyne, and worked south from the major station at Cape Stosch. On re-uniting, the survey was carried outwards to Jackson Island at the south entrance of Gael Hamkes Bay.

During these days the Doctor had frequent opportunities to explore old Eskimo sites, locating and measuring the tent rings and winter houses, and on occasion excavating some of the latter. Bell was his constant assistant, and, as the work meant minute inspection all along the coasts, others also readily volunteered their help. The map on which the Doctor has now plotted his work shows not only the distribution of the different types of dwelling but also the equally important regions where careful search showed no traces of former habitation. Granta Fjord and Loch Fyne were of this order: Clavering Island, on the other hand, was rich in sites. As the work of investigation and collecting proceeded, the Doctor found himself faced by such questions as the probable routes by which the Eskimo had reached the coast, the possibility of more than one immigration, and the reasons for their disappearance. Such evidence as we have points to one period of immigration only, and to arrival round the north of Greenland; but on the question of their disappearance there is no clear evidence which can be put forward.

Franz Josef Fjord.

The north-north-east gale in the third week of July had pressed the pack-ice against the coasts, but with the beginning of August a fresh spell of fine weather slowly carried the floes once more out to sea, and favourable land water was again established. It was a chance, which might not recur, of rounding Cape Broer Ruys and visiting Franz Josef

Fjord. Discovered in 1870 and made fully known by Nathorst in 1899, Franz Josef Fjord takes rank as one of the longest transverse fjords: from Cape Franklin to the head is over 100 miles in direct line. More remarkable, however, is the absence of any planes of weakness which could have controlled its origin. Like the neighbouring fjords and sounds it cuts across Tertiary lavas, Devonian sandstones, Silurian limestones, and Archæan gneisses and schists entirely unaffected by the changes in the rock types. There are not, as in the Scottish lochs, certain definite lines of weakness which control the direction of valleys and lochs. Examination of the East Greenland fjords rather suggests a system of drowned valleys, but not of tectonic origin, and this is more especially indicated in the western ramifications. It may here be stated that there is abundant evidence, as might be expected, of a much more intense glaciation at a not very distant date. The 1400 feet high Jackson Island was completely submerged by ice, and the extreme case was the finding of erratics 2500 feet above sea-level on Clavering Island.

We were prepared for a richer vegetation than on the outer coast, but it was a surprise nevertheless to find such luxuriance as we did. It was most marked in the more sheltered parts: in Kjerulf Fjord under the slopes of Riddarborgen the Arctic Willow and Birch were as much as 12 to 18 inches high; generally, however, their habit is less erect. Taken as a whole, the vegetation gives the valleys a softer tone and colour than one would expect in such high latitudes. That the latter is not more markedly green is due probably to the low precipitation. In the week we spent in the fjord and in the ensuing fortnight on the outer coasts we had uninterrupted fine weather. It probably represents the prevalent conditions, and this view is strengthened by a snow-line seldom below 4500, and often above 5000 feet. We found it a region in these summer days of continuous sunshine and light airs: sea fogs were met with only on the outer coast. To us it was the grandest region visited last summer; this was partly due to the fine weather conditions, but more to the impression made on us by the scale and by the colour. One has only to cite the contrast between the iceberg-strewn waters of the fjord and the reds and greys of the rock faces to picture the possibilities. The most striking scenery is that round the Devil's Castle, for here the rocks are brightly banded, but of almost equal merit are the views at Cape Weber, at Eleonoren Bay, and at the mouth of Antarctic Sound.

The head of the fjord was reached on August 5. In the early morning we had passed along the foot of Payer Peak. It was from here in 1870 that Copeland and Payer (standing at a height of 7000 feet) reported a greater mountain to the west: "One thing attracted our attention more than anything else, and that was a monstrous pyramid of ice to the west, rising about 4850 feet above a high mountain ridge. This glorious peak could bear none other name than that of Petermann, the honoured

originator of the first German Arctic Expedition: its real height must have approached 11,000 feet." Later Nathorst was to cast doubts on the pre-eminence of Petermann Peak, and on his map a much lower mountain, about 8000 feet high, is given this name. Considering that Nathorst's work was done from sea-level, we did not take his criticism too seriously: a coloured lithograph in the German edition of Koldewey made it clear that the mountain was something outstanding and probably at such a distance as only to be visible from a height. Our plans allowed of a journey into the interior in order definitely to locate Petermann, but in addition we had our secret hopes of a possible ascent. The Nordenskiöld glacier, debouching at the very head of the fjord, seemed, if its surface were good, to be the most likely route to the west. In this we were disappointed: it is highly crevassed and offers mountaineering difficulties which are undesirable in the early stages of a glacier journey with heavy loads. Apart from that, the head of the fjord was blocked with the *débris* of broken bergs, and the nearest the ship could be taken to the glacier was about 4 miles. The steepness of the mountain sides showed, moreover, that a traverse along the side of the glacier was unlikely of success.

A flank attack was necessary, and was undertaken from the small lateral inlet called Kjerulf Fjord. A party of six landed at the mouth of Ridderdal, the valley immediately to the south of Riddarborgen, and established camp the same night at 3000 feet on the south slopes of the latter mountain. The tents were pleasantly pitched on springy turf formed of heath plants in which crowberry and blaeberry were prominent. Ahead were vast snowfields rising to the west, and on them we hoped to reach not only the ridge which bounded the western horizon but to find there the plateau region generally postulated in the interior. From the camp we could see the ship far below us in Kjerulf Fjord, but in a by no means enviable position. The fjord was filled to its head with a perfect phalanx of bergs, for the most part 60 to 80 feet in height; most of them were aground, but even then they were not the safest of neighbours. It was a risk, therefore, to retain the ship in this position; there was no safe anchorage, however, nearer than 20 miles, and there was the chance that if the ship withdrew to safety her return might quite likely be prevented—a set of the brash ice from the head of Franz Josef into the mouth of Kjerulf Fjord was most to be feared. The captain was unwilling to face this possibility, and preferred to remain in Kjerulf Fjord. We minimized the risk by deciding on a maximum trip of five days in the mountains, and an immediate return to the ship should the weather break.

The first day's climb had been an easy one. The next (August 6) was to give a better measure of our rate of travel. On this day we transported camp about 4 miles farther west, and climbed a further 4000 feet. Late in the evening we reached the western ridge and had our first sight

of Petermann Peak. This view was decisive: there could be no doubt of its identity with the mountain first seen by Copeland and Payer, and that its height exceeded 10,000 feet; at the same time we saw that to reach it and return would require at least six, and probably eight, days. It was distant over 20 miles from our high camp, and to reach it two intervening ridges, each of the order of 6000 to 7000 feet, would have to be crossed. We therefore decided to climb lower peaks in the immediate neighbourhood and to return to the ship as arranged. The next day Manley took a small party over the Cambridge Peaks, while others climbed Riddarborgen. As viewed from the highest Cambridge Peak (7670 feet), a mountain lying 5 or 6 miles north-west and perhaps 8500 feet in height may have been that seen from the fjord by Nathorst and assumed by him to be Petermann Peak. The view to the west is of interest. There is here no ice-cap, as one would expect; mountains and valleys follow one another as far as the eye can see over a distance of probably 80 miles. Petermann moreover is not the only outstanding peak, and has its rivals, notably Gog and Magog to the north-north-west, and the Mount Shackleton to the west-south-west. Perhaps some day these will all attract the mountaineer, and if they do he will be well repaid for the difficulties and dangers of reaching his playground. As much depends on the weather in a new region, it may be emphasized that Nathorst recorded exceptionally fine weather for a period of three weeks, that our own experience was the same, and that Clavering (though farther north) had similar good fortune. These, presumably, are the normal summer conditions.

We left the upper reaches of Franz Josef Fjord much against our will. Many of the geological problems were still unsolved, though in one respect we made a material advance by settling the relationship of the Lower Palæozoic limestones of the Devil's Castle to the underlying Archæan. The latter rocks were found to underlie a fault of very low hade along which the Lower Palæozoic limestones and shales have probably been driven westward. Thrust planes of this nature are familiar from the North-West Highlands and from the Scandinavian Peninsula, where in the one case Caledonian folding has driven the rocks to the west, and in the other to the east. The present discovery throws a new light on the tectonics of Greenland, and shows that Caledonian movements are probably not confined to the mountain range recently explored by Dr. Lauge Koch in the extreme north-west.

Hudson's Hold with Hope.

The Loch Fyne party led by Barnett in July had carried their mapping to the head of that inlet, but without being able to connect their farthest with the Nathorst map. To achieve this result the ship steamed to the head of Musk-ox Fjord, and the necessary connections were made linking Loch Fyne not only with Musk-ox Fjord but also with Mackenzie Bay.

One other result of the detour was the unexpected discovery of a very large valley running parallel to and west of Loch Fyne. Some of the party crossed the mouth, but my own acquaintance with it is confined to a view from the top of Ladder Mountain, the most northerly of the Giesecké Mountains; from there (at a height of 3150 feet) we looked right up the valley and could see that its upper stretch connects by an easy pass with the mouth of Loch Fyne. To a geologist it should well repay a visit, as it lies between the Devonian of Musk-ox Fjord and the Triassic of Cape Stosch, and seems free of the Tertiary lavas and sills which elsewhere to the east and south have smothered all chance of finding the sequence of events between Devonian and Trias. Its general course is sufficiently parallel to Loch Fyne to invite some comparison: the latter differs from all the other inlets by being extremely shallow, and having a north and south direction. Loch Fyne, however, appears to lie along a line of faulting; but such is not, so far as we could see, the case with the Great Valley.

From Ladder Mountain White took rays to Mackenzie Bay and the mountains on Hold with Hope. It was some days before he was able to make full use of the sights, as on reaching Mackenzie Bay we were fogbound for three days. During the detention there was bright sunshine on the mountain-tops, while the conditions at sea-level were a repetition, but in this case quite unwanted, of the foggy weather which had so favoured the pendulum experiments at Sabine Island. Ultimately, between August 17 and 19 three clear days saw the map completed by White and Barnett of the region (from Jackson Island to Cape Franklin), generally styled Hold with Hope.

It will never be possible definitely to fix the limits of Hudson's great discovery in 1607, but his description agrees very well with the country back of Cape Broer Ruys. In 'Purchas his Pilgrimes,' in the Third Book of the Third Part, chapter xiv., we read:

"... This day at two in the afternoone [June 20th, 1607] it cleared up, and wee saw the Sunne, which wee had not seene since the second of this moneth. Having steered North North-east, two watches and an halfe, fifteene or sixteene leagues wee saw Land on our Larboord, about foure leagues off us, trending as wee could ghesse North-east and South-west. . . .

"The one and twentieth, in the morning we steered North-east, and East North-east two watches, five or sixe leagues. Then it grew thicke fogge. And we cast about, and steered North-east and East North-east two watches, five leagues, finding wee were embayed. The wind came at East South-east a little gale: we tacked about and lay South. All this night was a thicke fog with little wind, East we lay with the stemme.

"The two and twentieth, in the morning it cleared up, being calme about two or three of the clocke: after we had a prettie gale, and we

steered away East and by North three leagues. Our observation was in 72. degrees 38. minutes, and changing our course, we steered North-east, the wind at South-east a prettie gale. This morning when it cleared up, we saw the Land, trending neere hand East North-east, and West South-west, esteeming ourselves from it twelve leagues. It was a mayne high Land, nothing at all covered with snow: and the North part of that mayne high Land was very high Mountaynes, but we could see no snow on them. We accounted by our observation the part of the mayne Land, lay nearest hand in 73. degrees. The many fogs and calmes with contrary winds, and much Ice neere the shoare, held us from farther Discovery of it. . . .

". . . And considering wee knew no name given to this Land, wee thought good to name it, *Hold with Hope*, lying in 73. degrees of latitude.

" The Sunne was on the Meridian on the South Part of the Compasse, nearest hand. Heere is to bee noted that when we made *The Mount of Gods Mercie*, and *Youngs Cape* [Jan Mayen], the Land was covered with snow for the most part, and extreame cold, when wee approached neere it: But this Land was very temperate to our feeling. . . ."

The features in Hudson's narrative to which attention may be directed are the east-south-east winds leading to his embayment, the absence of snow on the high ground, and the latitude of Hold with Hope as something above 73°. One would have felt certain had there been a reference to Bontekoe Island, but apart from that one can be pretty confident that Hudson was working his ship in Foster Bay and as the weather cleared had views into the region beyond Mackenzie Bay. That he did not see more land such as Bontekoe Island and the snow-capped mountains to the west is easily explained by the fogs which he experienced, and which are of course typical of the coast.

The land, as Hudson said, is markedly bare of snow, thus recalling the Pendulum Islands. At the same time there is similarity of structure; lavas proper, together with sills, predominate to the east of Loch Fyne, and also form the Giesecké Mountains west of Mackenzie Bay. Between the two inlets, however, there is low ground of alluvial origin, and a pretty clear indication that the sea once spread across between them and to Musk-ox Fjord. This depression is so well marked that if the name Hold with Hope is to be attached to a definite geographical entity it must be confined to the region east of a line from Mackenzie Bay to Loch Fyne. The area in question forms a neat unit bounded at its four corners by Cape Stosch, Jackson Island, Cape Broer Ruys, and Mackenzie Bay. At the same time one notes that Hudson may have seen a little more than is contained in Hold with Hope as at present defined.

The Hold with Hope mountains rarely exceed 3000 feet, and this is sufficient to account for the absence of glaciers of any note: the exception is in the north between Cape Stosch and Cape James, where the terraced

Little Finsch Island and south side of Gael Hamkes Bay

Hanging Glacier above Ridderdal

Suess Land, Franz Josef Fjord

Tertiary lavas are sufficiently high to carry cwm glaciers. On the other hand, though the low precipitation is in the main responsible for the high snow-line, the effect of the country rock itself is not entirely negligible: the extremely porous nature of the lavas must probably play a part in preventing undue accumulation of snow. In this connection reference may be made to the peculiar conditions at Cape Parry on Traill Island, a heavily glaciated peninsula lying between ice-free regions of similar height and area, but of markedly different rock constitution.

For the next two years Loch Fyne and Mackenzie Bay will be the scene of an interesting hunting experiment. Early in July we were able to announce the favourable ice conditions to Tromsö by wireless: a party of six Norwegians had only been waiting for some such message to put into operation a scheme for two seasons' hunting in East Greenland. They immediately sailed in the *Ringsael*, and early in August were landed, three at Mackenzie Bay and three at Cape Stosch. The main huts are there, but smaller shelters are also to be erected at the head of Loch Fyne and a little to the west of Jackson Island. There are already older (Danish) huts at Cape Broer Ruys and near Cape Kraus. This network will facilitate trapping over a very wide area, and should definitely test out whether East Greenland has any future for winter hunting. My own impression is that it is unlikely of success: foxes are not as common as on Jan Mayen, the reason probably being the small number of bird colonies on Hold with Hope; and apart from that, the problem of relieving the stations at proper intervals is made extremely difficult by the uncertainty of always finding favourable pack-ice conditions.

There is no shortage of game in the widest sense, but a scarcity, so far as we could see, of fur-bearing animals. Musk oxen, for instance, though concentrated in certain more suitable localities, are on the whole extremely abundant. Though we saw them in large numbers—between two and three hundred in all—we nevertheless felt certain that there is danger of their rapid extinction unless measures can be taken either to protect them altogether or at least to ensure that they are only killed for fresh meat. It is their misfortune never to have been hunted and to be extremely tame as far as man is concerned. The danger would not perhaps be so acute were it not that in recent years it has become profitable to sell young calves in Europe and America, and to capture two calves generally means the destruction of a herd of say fifteen adults. There are several records of sealing sloops from Denmark Straits, which have gone out of their way to visit East Greenland merely to round up a herd of musk oxen and capture the young ones. I hope therefore that the Danish Government, who have now the sovereignty in this part, will do all they can to safeguard this most interesting European mammal—an English native in Glacial times.

Swiss Land, Franz Josef Fjord

Hanging Glacier above Ridderdal

Geographical Society Island and Traill Island.

Since leaving Musk-ox Fjord it had been found necessary to carry on the work both night and day. This for the crew made no difference in the routine, as for them it had been a case of six hours on and six hours off ever since leaving Norway in the middle of June. White and Barnett now undertook night shifts with the plane-tables, while Manley's work was generally by day inasmuch as he was also responsible for astronomical positions and was of course dependent on the sun. The willingness to do overtime alone made it possible to finish the map, and incidentally the night workers had their reward, as it was then mostly that bear adventures and other hunting excitements took place.

White was on duty as we crossed the mouth of Franz Josef Fjord towards the so-called Cape Laplace. To him fell the unenviable task of fixing the Broch Islands, a name which we owe to Payer and Koldewey; as White reached one island, another would spring up hydra-headed from behind; so that before the night was finished the original few had become thirteen. These islands, which Nathorst has placed at the mouth of Sofia Sound, were, as originally discovered, the island group at the mouth of Dusén Fjord to which Nathorst has since given the name Winter Islands. It seems unnecessary to change back the name (the German expedition saw them from some distance), but one may note that both Winter Islands and Broch Islands are the scattered outcrops of two great intrusive basalt sheets, and constitute a region very similar to Deevie Bay and the mouth of Freeman Strait in East Spitsbergen. A ship picks its way among the islands only with difficulty, as they mark rather sudden shallowings of the water; but once inside them their shelter would provide excellent winter quarters; this is specially so behind the Winter Islands, where the holding ground is good and the threshold sufficiently shallow to prevent bergs drifting in.

White now showed himself an expert in reconciling Scoresby's chart with the land features as we now saw them close at hand. In every case Scoresby's capes represent high mountains standing well back from the coast: we have therefore transferred his names to the mountains themselves, the actual features which he sighted. Cape Humboldt was either Bontekoe Island or the mountain mass between Dusén Fjord and Franz Josef Fjord; Cape Rossel was quite definitely the next mountain to the south, but in the interval it has been already named Mount Celsius by Nathorst and the cape in front wrongly identified as Cape Humboldt. Laplace, Leitch, and Freycinet, are clearly the three mountain masses on the east side of Geographical Society Island (as named by Nathorst). Cape Laplace disappears in favour of Cape Mackenzie, as the north-east point is found to be the bluff formerly known as Mackenzie Island. It is separated by several miles of very low ground from the main mass of Geographical Society Island, and its being mistaken for an island by Clavering and others is quite easily understandable.

White and Barnett carried the mapping across Cambridge Bay, and on August 21 in Vega Sound made an important connection with the Swedish map-makers who had approached the same spot from the west and anchored at the Scott Keltie Islands. I had an opportunity that day of occupying a high station with Courtauld: our view swept from the newly discovered Cape McClintock and Franklin Island to Cape Parry and into Vega Sound. To the south-west we looked right across Traill Island to the Syltopparne, quite possibly the Werner Mountains of Scoresby. Once more we found ourselves in a region of Tertiary lavas; but whereas the feature of Sabine Island was its numerous horizontal sills, and in the Giesecké Mountains the predominance of lavas proper, here the topographic control was due to the steep dip of a few extremely massive sills. Of this Nordenskiöld Island (replacing a cape which was found not to exist) may serve as the type.

Late on August 21 we reached Cape Parry on Traill Island and came to a full realization of the great extent of Mountnorris Inlet. Little attention has been paid to this discovery of Scoresby's and to the fact that one of his whale boats navigated the inlet and discovered the numerous Craig Islands. Unfortunately, our survey of this inlet lacks completeness. A station was made high up on Cape Parry and a second planned for Cape Young, but before the latter was occupied the sun had set and the visibility become very poor. For the first time for three weeks the sky was overcast (apart, of course, from coast fogs). The change in the weather was ominous, and as the wind was now blowing from north-east it was obviously advisable to defer (indefinitely, as it proved) entry into the inlet itself.

Early on the 22nd landings were made at Cape Young to fix the position, and at Cape Simpson to enable the Doctor to visit the Eskimo village found by Captain Scoresby, Senior. This peninsula was classic ground, for it was here that the son landed to make his map and sit astride the sharp ridge at Cape Moorsom while the father crossed the hills to Cape Simpson. We had hoped to spend some days both at Mountnorris Inlet and at Cape Simpson, but in this were disappointed. The weather definitely broke on the 22nd, and there was every indication of a gale similar to the one experienced at the Pendulum Islands. We were soon aware of ice drifting in from north-east, and at once decided before it should be too late to steer south for Scoresby Sound. One important matter, however, was still to decide, namely the western limit of Davy Sound. Nathorst writes that this should be taken only as far as it could be seen by Scoresby. Clouds were now rolling down the hills, but not before we definitely fixed, from the position where Scoresby's own ship must have been, that Davy Sound extends to Cape Petersens at the mouth of Yacht Club Fjord.

Scoresby Sound.

Heavy rain was falling while we were off the Liverpool Coast. We were now intent on making a quick passage to Scoresby Sound, but it was nevertheless necessary to sail in as close as possible to the land, as since leaving Hold with Hope a constant look-out was being kept for the lost crew of the Norwegian ship *Anni*. The *Anni* wintered in Mackenzie Bay in 1922–23, and was responsible for the daily weather messages which came that year from East Greenland *viâ* Jan Mayen. The last report of the ship with its crew of five was their sailing for home in August 1923. This, the worst ice year recently known on the coast, was responsible for the misadventures of two other ships, the *Conrad Holmboe* and the *Teddy*.* That the *Anni* was crushed by the ice there can be no doubt, but there was still a hope that the crew might have reached the land. We failed to find any trace, however, over a distance of 200 miles south from Mackenzie Bay, and must therefore assume complete disaster to the whole party.

Scoresby Sound is now in charge of the Greenland Administration, and developments are already in progress. A preliminary reconnaissance was made in 1924 and a site chosen at Amdrup Havn in Rosenvinge Bay for a colony of Eskimo from Angmagsalik. The colonists arrived, with their families to the total of ninety, in 1925. Apart from the interest of seeing this new development, we were also anxious to meet Dr. Lauge Koch, who intended to winter here. We had anticipated a little difficulty in finding the headquarters of the new colony, more especially as the weather was thick and foggy as we entered the Sound. We found unexpected pilots, however, in the shape of several kayakmen fishing among the ice-floes, and in due course dropped anchor off Government House and found Dr. Koch in process of erecting his own winter hut on the adjoining headland. Dr. Koch, with two assistants, has been retained by the Danish Government in order to make a fresh geological map northwards from Scoresby Sound; and his original intention of crossing the ice-cap to the west coast has been abandoned.

At the time of our visit the Eskimo colony had been in existence for one year, and the Governor was able to report excellent hunting results. Some allowance must be made for it being a fresh field in which the skilled hunter was bound to make a success of narwhal and walrus stalking. Apart from that the outlook is very promising, and it is the Government's intention both to extend the colonies in Scoresby Sound and also to penetrate to regions farther north. At present there are Eskimo villages at Cape Stewart, Cape Hope, and Cape Tobin. It should be noted that this is a colony of Angmagsalik Eskimo of pure race, the Angmagsalik settlement having only been discovered in 1884. The Governor, however, is a Greenlander from the west coast. The

* Gunnar Isachsen, "Grønland og Grønlandsisen." Oslo: 1925. K. R. Dahl, "The *Teddy* Expedition." Translated by G. I. Colbron. London: 1925.

prospects of the new colony at present are good, but success depends largely on the retention of good hunting stock; there may, of course, also be difficulties of access from without to contend with, if not at Scoresby Sound, then certainly in the areas farther north.

Scoresby Sound was left late on August 23, and the ice-pack outside, Cape Swainson passed through in four hours. A course was set to Reykjavik, but rough weather delayed arrival till August 28. Our good fortune had now deserted us, and we experienced two more gales on the passage to Aberdeen, so that it was not until September 8 that we made the Scottish port.

APPENDIX I.—SURVEY

G. MANLEY

General Account.

The existing charts of East Greenland from 72° to 75° N. have been made mainly from the results of four voyages during the last century, namely Scoresby's in 1822, Clavering's in 1823, the German Expedition under Koldewey in 1869–70, and Nathorst's Swedish Expedition in 1899. Land was known to exist here at a much earlier period, and the seventeenth-century Dutch maps show one or two features which were reported by various whalers, but Scoresby was clearly the first to lay down the coast with any pretence to accuracy.

The condition under which previous voyages were made should be reviewed in order to show the type of work which remained to be done. Scoresby laid down much of the coast north of 72° from a ship many miles to seaward: this was necessary owing to the presence of ice immediately along the coast. Clavering was able to supplement the northern part near Gael Hamkes Bay in a short boat journey undertaken during Sabine's pendulum experiments; the chart is mainly the work of Henry Foster, one of the midshipmen. The German expedition had as its main object the coast north of Sabine Island, and made only short journeys southward, where they added a little to the region covered by Clavering: their maps are the work of Copeland, Börgen, and Payer. Finally, the Swedish expedition devoted its attention entirely to the inner fjords, covering during their short season a great extent of new country, but not having the time or opportunity to visit the outer coast; Åkerblom was responsible for the astronomical work, and Dusén for the plane-table survey.

There remained therefore a considerable stretch of uncertain seaward coast-line in these latitudes. Survey apparatus was taken, with a view to mapping this area, either from the sea, if that were possible, or by overland marches if the ice were impeding access to the coast. The equipment included a 6-inch Cary-Porter micrometer transit instrument, a 3-inch theodolite by Watts, plane-tables, and miscellaneous accessory instruments.

As the circumstances under which survey would have to be carried out were doubtful, no very definite plan could be drawn up until we were on the spot. During the progress of the pendulum observations on Sabine Island parties also carried out some survey work; this was primarily by way of practice in using and transporting the instruments, but as a result some useful detail has been added to the existing (German) maps of the island and its neighbour, Little Pendulum Island.

Definite work was begun on July 27 in the inner part of Gael Hamkes Bay

at Cape Stosch (so named by the Germans). The principle adopted was to fix a number of points by triangulation from a small base, and to hang plane-table detail on those points. A break in the weather at first rendered plane-tabling difficult following ordinary methods; at length, however, the bay was mapped and the Loch Fyne detail tied in. Various incidents hindered the first operations on Hold with Hope, notably the presence of ice on August 3 near the important station of Jackson Island. The period of August 4–11 was spent in the journey up Franz Josef Fjord; on the return we entered Musk-ox Fjord and fixed the head of Loch Fyne independently. While fog prevailed on the coast it was impossible to make a trustworthy connection between Mackenzie Bay and the more northern fixed points. After exasperating delay, however, the fog lifted, and Jackson Island was re-visited on August 18 to fix the Hold with Hope area. Subsequently, by dint of working both by day and by night, we were able to cover the whole outer coast from the entrance to Franz Josef Fjord down to Cape Simpson. It was also found possible to link up with Nathorst's astronomical position on the Scott Keltie Islands in Vega Sound. Long theodolite rays were used again for the major framework, the detail being begun anew from a small base.

Every member of the party shared in the survey operations: most of the detail survey, however, was carried out by White and Barnett, Manley taking charge of the theodolite and astronomical determinations, and of small sections of coastal detail when the necessity arose. Courtauld and de Bunsen gave valuable assistance with panoramic photographs.

In the reconnaissance of Petermann Peak, the heights of the high camp, and of three points on the ridge which were ascended, were based on the readings of three aneroids and a hypsometer. A light plane-table was used to determine the distance and bearing of the peak and of a point on the shore of Kjerulf Fjord. After descending a party measured a short base on the shore to determine the position of the peaks which had been climbed, and also their azimuths. Petermann Peak itself lay between 20 and 22 miles almost due west from the Cambridge Peaks, and its height may be taken as 10,200 feet with a probable error of 400 feet; its elevation being determined by Abney level from two points, by two observers, with repeated observations. The index error of the level was later determined several times as carefully as possible.

Adjustment of Map.

In the map as produced two changes in regard to earlier surveys need explanation. The outline of Tiroler Fjord, as plotted by Payer during a late autumn sledge journey in 1869, has been revised. It was found that in the endeavour to bring this fjord to join the head of Gael Hamkes Bay he extended it westward. Clavering had laid down Jordanhill in 1823, and it appears that Payer believed the land mass of similar shape, which he saw in the twilight of October, lying to the south-west, to be Jordanhill. The discovery of Granta Fjord, which is not shown on Payer's map, makes it clear that he mistook its entrance for the bay which he knew existed on the northern side of Jordanhill. A bearing from Granta Point, however, to a large valley lying north-east, which appears to be that shown on Payer's map on the north side of the fjord, gives a position-line for the revised outline. The bearing and size of Upper Tiroler Fjord are the same as on Payer's map. The portion, however, of Lower Tiroler Fjord from the Orientirungs-Spitze westward has been shortened and the bearing changed slightly; the fjord up to Orientirungs-Spitze was probably well determined by a latitude sight taken there.

The second amendment consists in bringing Cape Borlase Warren approximately a mile farther south. The new position rests on the evidence of unexceptionable bearings from the Finsch Islands, and as it is a low-lying cape it is quite possible that Payer's party in the winter were confused as to its exact outline.

Astronomical Determinations.

Theodolite observations were carried out frequently; it was hoped to use certain sextant determinations, but these were soon found to be quite untrustworthy owing to extraordinary refraction. Finally, six latitude observations, seven of longitude including double observations at Granta Point and Musk-ox Fjord, and seven of azimuth have been actually used in plotting the map, together with four predetermined positions—those of the Germans at Cape Mary and Sabine Island, and of the Swedes at Cape Franklin and the Scott Keltie Islands. The new positions are as follows:

	Lat. N.	*Long. W.*
	° ′	° ′
Cape Stosch	74 04·5	—
Granta Point	74 20·8	22 02·0
Jackson Island (west shore)	—	20 18·7
Mackenzie Bay Hut (= Mygbukten)	—	21 34·5
Cape Bennett	—	21 39·1
Head of Musk-ox Fjord	73 38·2	22 21·0
Cape Mackenzie	72 55·0	21 52·4
Cape Hovgaard	72 43·5	22 34·3
Cleft Island, Cape Young	72 16·7	—

Azimuths were observed at Great Finsch Island, Jackson Island, Cape Bennett, Musk-ox Fjord, Cape Mackenzie, Cape Hovgaard, and Cleft Island.

The primary latitude at Cape Stosch was observed with the 6-inch theodolite. This was such a clumsy instrument for carrying about on shore, however, that subsequently the 3-inch Watts vernier instrument was always used. This make and size of theodolite was found most satisfactory; and it could be easily carried in a rucksack when high points were visited. Readings could be estimated to 15″; the level value was 25″. As timekeepers, the half-chronometer watches lent by the Society were used throughout, being rated at intervals by wireless signals from Nauen or Bordeaux.

The sun only was observed, except on the night of August 21–22, when the Pole Star was visible. For latitude sights, sets of eight or twelve circum-meridian altitudes were taken; for longitude determinations also, eight or twelve altitudes. The sun's altitude on these occasions varied from 12° to 28°.

As only one observer was available for the astronomical work, and as it was often impossible to wait even a few hours, several of the determinations are of latitude or longitude only. The check provided by the observations of previous expeditions, however, has been so extremely satisfactory, that there appears no reason to doubt that the chart of the coasts as now presented is substantially accurate.

As regards precision, Åkerblom of the Swedish expedition frequently took fewer sights for his longitudes, and had also to estimate his chronometer rate over long periods; the latter, however, was good. He suggests a precision of 2′·5 in longitude, and 0′·3 in latitude, and says that "probably the errors are in general considerably smaller." It seems reasonable to believe

therefore that the longitude observations of last summer are within 3′ and the latitude sights within one-third of a minute, that is, that the stations as plotted are within a mile in longitude and half a mile in latitude of their true position.

Plane-table Work.

The major equipment consisted of three plane-tables, two 24″ × 18″ from the Royal Geographical Society, and one 18″ × 12″ from the Cambridge Geography School, one Reeves telescopic alidade, three plain alidades, and three clinometers. The equipment was tested out during a three days' trip round Sabine Island. It was then found that the larger plane-tables were on occasions too heavy and cumbersome for travel where speed and agility were often desirable, and that the smaller table was very much more suitable, especially for mountain work, of which there was a good deal. On the other hand, the scale to which we worked, 1 : 200,000, was sometimes a little too large for the smaller plane-table: it should be remembered that visibility is extraordinarily good, and selected triangulation points are generally great distances apart. Rays were sometimes taken to objects distant 50 miles or more, *e.g.* Cape Broer Ruys from Cape Mackenzie, and Bontekoe Island from Cleft Island.

The adjustment of the plane-table sheets was at first only carried out with considerable difficulty. Apart from the liability to confuse mountains, where all are so much alike, there were also hitches where one party would take over from another. White, however, developed considerable ingenuity in weeding out undesirable points and ensuring accuracy, and his ultimate intersections proved exceedingly satisfactory. In his view there is still a little doubt in regard to Mountnorris Inlet: the map there depends on two stations only, one of which was occupied after the sun had set, so that it was not possible to see clearly the outline of the inner end.

APPENDIX II.—PLACE-NAMES

LIEUT. P. F. WHITE, R.E.

The early maps of Scoresby (1822) and Clavering (1823) between them cover the whole coast from 72° to 75° N. lat.; and most of the main features, therefore, have been named by one or other of these observers. The two maps, it may be noted, overlap from 73° northwards, and one is faced with the difficulty of deciding whether Scoresby's names should have preference over those given by Clavering a year later. Any claim to priority however, must be dismissed in view of the fact that Scoresby's ship was never less than 30 miles from the coast north of Cape Parry (about 72°30′), whereas Clavering and Foster worked along the coast, and were frequently ashore. Foster's map is extremely careful and accurate. The same may also be said without reserve of Scoresby's chart of the Liverpool coast and of the east part of Traill Island. Though prevented from reaching the coast farther north, partly by the necessity of carrying on whaling, partly, no doubt, by the ice-pack, he nevertheless made a very accurate panorama of the distant land. From it the land features were easily recognized and comparison made with Foster's map: more particularly it was at once seen that all the features originally named as capes by Scoresby were in reality mountains back from the coast.

The German map of 1870 has faithfully reproduced all the early names, and added many minor features, naming them as far as possible from their

appearance, *e.g.* Stufenberg, Kronenberg, Steinmann Spitze, etc.; this most excellent rule was of the greatest service to us. Still later, Nathorst did his best to reconcile Scoresby's names with the detail in Foster Bay: as will be shown below, he mistook the case of Cape Rossel and Cape Humboldt, and failed indeed to realize that Scoresby was only seeing the high ground.

Little Pendulum Island.—On Scoresby's panorama there is no doubt that his so-called Gael Hamkes Land is in reality Little Pendulum Island. It is of interest also to note that this well-known landmark (though distorted by refraction) is figured by Manby in his 'Journal of a Voyage to Greenland in the year 1821.' Cape Desbrowe at the south-east corner was so named by Clavering. It is placed at the south-east corner on his map although the description in the letterpress really applies more closely to the south-west cape. The latter rises very steeply from the sea, and may be conveniently called Cape Stufenberg, after the mountain above. The retention of the full name, Little Pendulum Island, is advisable, if only to prevent the assumption that the gravity experiments were made here; the change of name of Inner Pendulum Island was perhaps unfortunate.

Sabine Island was originally named Inner Pendulum Island by Clavering and renamed by the Germans in 1870. The *Germania* wintered in the harbour which now bears its name: Copeland's observatory was on the west side of the harbour, while Manley's tents in 1926 stood at the cairn on the eastern point.

Clavering Straits, named in 1870, are shown on the Scoresby panorama as Kater Bay. The *Heimland* anchored on the Sabine Island side in a small bay not previously known, which we propose to call Heimland Havn; Lars Jakobsen Point, which gives full protection on the south side, is named after the captain.

Wollaston Foreland, named by Scoresby in 1822, first appears on Admiralty charts in 1872. Scoresby's Cape Clark marks the south side of Queen Augusta Valley on the slopes of the Sattelberg; similarly Cape Beaufoy marks the slopes of the Hühnerberg, and Cape Herschell a mountain behind Cape Borlase Warren. All three names should disappear. Cape Wynn and Cape Borlase Warren, on the other hand, are Clavering's names, and were actually visited by him.

Clavering Island forms a prominent part of Scoresby's panorama. Cape Brinkley and Cape Brisbane are clearly mountain masses, the latter probably immediately behind Clavering's Cape Mary. Tiroler Fjord, which runs round the north side of the island, is more properly a sound, except in the extreme upper portion. It may be noted that ships cannot navigate much beyond Kirchenpauer Bay on the east, or north beyond the mouth of Granta Fjord on the west. Norwegian hunters commonly refer to Kirchenpauer Bay (of Payer and Koldewey) as Clavering's Bay.

Gael Hamkes Bay.—In all probability the bay seen by the Dutch skipper of that name in 1654, and identified as such by Clavering. Scoresby names it Scott's Inlet, and for a short period (1872–75) this name appeared on Admiralty charts. The bay proper ends at the Finsch Islands; the water beyond has no name, but generally we found ourselves calling it the Inner Bay. Jackson Island is Scoresby's name, Cape James and Cape Mary Clavering's.

Granta Fjord.—This inlet was overlooked by the Germans, who mistook the hill mass on its south side for Jordanhill. Certain adjustments must therefore have been made by them to bring their observations into line with Clavering's. Cape Blosseville and Cape Oetker have been left as placed by

the Germans, but it is clear that they were applied originally to features near the mouth of Granta Fjord.

Jordanhill was named by Clavering. We have added a similar name, Scotstounhill, to the steep mountain mass which lies farther west up the glacier.

Hold with Hope was clearly a mountain land free of snow to the north of Foster Bay. Hudson's original description, in fact, agrees very well with the mountains east of the Mackenzie Bay—Loch Fyne depression; this has been recognized by both Nathorst and Clavering. The name should not be applied to Cape Broer Ruys. It may be noted that Scoresby gave the name, Home's Foreland, to the extreme north-east portion of Hold with Hope. We found a close resemblance between Scoresby's panorama of the outer coast and photographs taken by us near Jackson Island; these showed that both Cape Holland and Cape Arundel are mountains; Koldewey transferred the former name to a small island off the coast, and we now propose to name a more northerly island after the latter. Cape Kraus marks the entrance to Carlshavn, a Danish hunting post from 1920 to 1923.

Cape Broer Ruys was identified by Clavering from an old Dutch chart (Pieter Goos 1666). Scoresby, however, mistook this very characteristic mountain group for Bontekoe Island. It is of interest to note that the snow-drifts to-day appear exactly the same as in Scoresby's time.

Mackenzie Bay and *Cape Bennett* first appear on Scoresby's chart, with this difference, that he mistook Cape Bennett for an island and regarded the low ground to the west as the main inlet. In 1922–3 a Norwegian hunting party wintered in Mackenzie Bay and sent out wireless weather messages from it under the name of Mygbukten.

Giesecké Mountains.—The name is taken from Scoresby's Cape Giesecké, presumably a mountain mass behind Cape Franklin.

Bontekoe Island was adopted by Clavering and Scoresby from a Dutch chart, possibly that published in 1818 to accompany Hidde Dirks Kat's "Dagboek eener Reize in de jaren 1777 en 1778." Scoresby, however, mistook Cape Broer Ruys for Bontekoe Island, and his own Cape Humboldt was probably the real Bontekoe Island.

Cape Graah and *Cape Humboldt* mark the north and south sides of Dusén Fjord. Nathorst's map has definitely fixed the names; but it is worth noting that Scoresby's Cape Humbolt was Bontekoe Island, whereas his Cape Rossel was Nathorst's Celsius Berg standing above the present day Cape Humboldt. Cape Graah is one of Koldewey's names.

Broch Islands: name originally given by Payer and Koldewey to the islands between Cape Graah and Cape Humboldt, and later transferred by Nathorst to islands off the mouth of Sofia Sound.

Mount Laplace, *Mount Leitch*, and *Mount Freycinet* mark three of Scoresby's capes which were easily identified as prominent mountains on Geographical Society Island (the latter one of Nathorst's names).

Cape Mackenzie.—Name now proposed for the north-east point of Geographical Society Island, the bluff at the point being formerly known as Mackenzie Island. It was regarded as an island by Clavering, but not actually named. The name first appears, together with Franklin Island, on the first edition (1872) of Admiralty Chart No. 2282, and owes its origin, apparently, to a mistake by the draughtsman, who had Cape Franklin and Mackenzie Bay in his mind's eye when engraving the copper plate.

Cape McClintock.—We propose to give this name to the south-east point of Geographical Society Island, facing Cape Parry on Traill Island.

Nordenskiöld Island takes the place of Nathorst's Cape of that name directly opposite Cape Palander; together they mark the inner gateway to Vega Sound. Cape Hovgaard, immediately west of Nordenskiöld Island, has been named to commemorate the Danish member of the *Vega* expedition.

Mountnorris Inlet and *the Craig Islands* were visited by one of Scoresby's whale-boats. Cape Parry marks the north side of the Inlet, and the Cleft Island off Cape Young the south. Scoresby's own landing was at Cape Moorsom, and his detail in this part is extremely accurate.

Davy Sound.—Nathorst, when describing the limits of King Oscar Fjord, suggests 72° 10′ as the end of Davy Sound, maintaining that this was as far as Scoresby could see. On one occasion our ship was as nearly as possible in the latter's position, and looking up the Sound we were able to see far beyond this and nearly to the opening into Yacht Club Fjord. By rights, therefore, Davy Sound should be carried as far as Cape Petersens and the Haslum Islands, and the name King Oscar applied to the north and south sound joining Yacht Club Fjord to Antarctic and Sofia sounds.

APPENDIX III.—THE PACK ICE

J. M. WORDIE

The year 1926 was such a favourable ice year that it not only gave next to no opportunities of seeing and studying pack-ice at close quarters, but may even convey the impression that the ice navigation off East Greenland need not present material difficulties. That such is not the case will be made clear from the reports on the ice in previous seasons.*

In 1919 the *Dagny* reached Sabine Island at the end of June: there was a certain amount of open water along the land. The return was made on August 11. In 1920 the *Dagny* was again on the east coast, but on this occasion failed to return in the autumn, and was forced to winter. In 1921 the *Teddy*, leaving Jan Mayen on July 7, reached Jackson Island on the 15th. On attempting to return on August 23 she became icebound, but was finally freed on September 3 and returned without further incident.

In 1922 a Norwegian ship reached Cape Borlase Warren in the middle of June. Towards the end of the same month the Danish vessel *Teddy* was within 40 miles of Sabine Island, but, becoming ice-bound, drifted to the south till July 10. She then left the ice, which was about 80 miles broad, and going round to the north finally reached Sabine Island at the end of July. Leaving the latter place on August 24, she passed out through very open ice in fog, reporting that open sea reached practically to Sabine Island. The Norwegian ship *Anni* reported the same almost ice-free sea in August: this ship proceeded to winter at Mackenzie Bay. 1922 has been regarded as an extremely good ice year.

By contrast 1923 has the very worst of records. The *Teddy*, making her third and last voyage, entered the ice north of Jan Mayen on July 8, and reached Jackson Island in Gael Hamkes Bay on July 15 without special difficulty. After visiting different hunting posts, engine trouble having developed, a course was set homewards on August 9. Heavy ice began to be met 25 miles east of Little Pendulum Island: this, combined with a good deal of fog, prevented her from making much easting. The drift began to carry her south. On August 21 she was regarded as definitely beset in 74° N.,

* Cf. 'The State of Ice in the Arctic Seas,' issued annually by the Danish Meteorological Institute.

16° 40′ W. The southward drift continued, carrying her past the Liverpool Coast and Scoresby Sound in September–October at an average rate of 10 miles per day. During the latter month the crew left the now damaged ship and lived on the ice. She was finally abandoned on October 31 in 65° 46′ N., 35° 23′ W., 15 to 20 miles from shore. By sledging across the ice the crew reached coastal islands on November 5, and ultimately wintered at Angmagsalik.

While the *Teddy* men were thus in trouble the Norwegian *Conrad Holmboe* was also meeting with misfortune. In this case the attempt to pass through the ice belt was not made until July 28; three days later she was within 60 miles of Sabine Island. On August 2 she became beset in 74° N. and slowly drifted, about 4 miles per day, past the mouth of Franz Josef Fjord. In September she was close to the Liverpool Coast (about 5 miles) and suffered considerable damage. On October 10, however, she won clear of the ice in 67° 30′ N., and was eventually able to reach Iceland.

It was clearly a very bad ice year, and warnings were sent by wireless to the *Anni*, which had wintered in Mackenzie Bay. Misled by the near land water, however, the *Anni* attempted to cross the pack; nothing more is known of her movements, and she is presumed to have been crushed, with the loss of all hands.

That same year a Cambridge party also hoped to reach the Greenland coast in the *Heimen* of Tromsö.* Jan Mayen was left on July 21, and the pack entered two days later in 74° 30′ N. By July 27 she had reached within 30 miles of the coast, and the land from Cape Broer Ruys to Sabine Island was plainly visible. In the last twenty-four hours of steaming she had passed from light open pack into a region of extremely heavy floes of great area separated by narrow leads. It was a position of considerable danger, and within a few hours pressure began and lifted the ship bodily on to the ice; the pack, however, eased later, and by careful seamanship the *Heimen* was taken eastwards into more open ice. On regaining the edge it was found that the ice margin had been driven 30 miles to the west between July 23 and August 4 by the dominant east and north-easterly winds. A week of fog succeeded. On August 11 a second attempt was made to reach the coast, but proved as unsuccessful as the first. The ice edge was then followed south towards Scoresby Sound, and found to have receded far to the west—as much as 100 miles off Jan Mayen in an interval of three weeks. Scoresby Sound was also unapproachable, and the attempt to reach the coast had to be given up.

In 1924 the *Godthaab* reached Sabine Island early in July; and the *Quest*, coming up from Scoresby Sound, arrived in August. This was in all probability a normal year. The next year (1925) proved to be a very good year, and reports of the state of the ice in July suggest that it was possible to reach the land anywhere up to 78° N.

To sum up, three moderate years were followed by a good year (1922). The next year (1923) was an exceptionally bad one, followed, however, by a moderately good one; finally, the next two (1925 and 1926) may be regarded as very good. In this period of eight years, therefore, it is the bad year rather than the good year which is rare. 1923 is rightly regarded as the worst of all these years, but it should be noticed that though no ships were able to pass through the ice in August, nevertheless the *Teddy* did so with apparent ease early in July.

In this connection the views of captains who have made a long series of

* The party consisted of Lord Cawdor, Lieuts. R. H. Maclaren and C. C. Duchesne, T. C. Lethbridge, L. S. Mayne, H. E. David, and J. M. Wordie.

voyages are of importance. Captain Thomas Robertson of the *Scotia* believed that there was only one year (1897) out of seventeen in which he could not come close to the land. Captain Øien of the *Laura* records difficulty in 1901 and 1904: during his other six voyages from 1906–1911, the difficulties appear to have been much less; but in 1907 and 1911 on the return voyage the *Laura* was beset in August and September, in each case for over a month.

A careful analysis makes it clear that there is every likelihood of ships reaching Sabine Island if the attempt is made early in July (or even in June). Difficulties with the pack are to be expected in August, in which month the winds may press the ice into a much closer belt. Ships might be well advised to listen-in for the Jan Mayen weather reports, and to defer sailing for home during or immediately following a spell of east or north-east winds. It also appears pretty certain that there may be abundant coast water combined with difficult pack conditions farther out.

The year 1923 gave a very good opportunity for close study of the pack and comparison with Antarctic ice. The general differences were known, but it was still a matter of surprise to find how light the Antarctic floes are by comparison with the great polar floes near the Greenland coast. The ice-pack of the East Greenland current consists of three elements: an outer fringe of Spitsbergen floes, the heavy polar ice, and an inner region of floes derived from landfast ice. The latter are seldom of more than one year's growth. The Spitsbergen floes may either be of flat young ice or else lightly hummocked: the thickness is of the order of 3–4 feet, and they are invariably snow-covered. The name is conveniently given to mark their place of origin approximately in the seas north of Spitsbergen, and probably in no higher latitude than 82° or 83°. From there the general drift takes them across towards Greenland and then down the east coast. In their appearance and age (never more than two years) they compare very closely with the ice-pack met with in the Antarctic in the Weddell Sea, and in the Ross Sea. The polar floes, on the other hand, do not find their equivalent in the south, unless the very old landfast ice near Gaussberg, to which Drygalski gave the name "blaueis," can be cited in comparison. The polar floes may exceed 10 feet in thickness, may be three to five years in age, and originate from far inside the polar basin itself. It is their age compared with that of the Spitsbergen floes which gives them their special characters; and more particularly the translucent appearance of hand specimens. The surface of the floe represents what has once been a maze of hummocks, but in the course of time has become rounded and flattened almost to what physical geographers call a peneplain. On this worn-down and gently undulating surface lakes and pools of fresh water are frequent: in the height of summer the surface of old floes may be almost free of snow. Not only are these floes very thick; their extent also is much greater than those of Spitsbergen type. Cases where the area exceeds 100 square miles are common: this frequently means that the leads are narrow and long, and if ventured into may close before a ship can cover the distance back to safety. It is the presence of the polar floes which gives the Greenland current its exceptional reputation, making navigation there a much bigger risk than in the Barents and Kara Seas.

APPENDIX IV.—WEATHER

G. MANLEY

In the compass of this appendix it is not possible to do more than summarize the conditions experienced; a more detailed critical analysis and comparison

of results is yet to be made. The following notes cover the more salient features of the weather observed from Jan Mayen northward, and as far as Iceland on the return voyage; that is, from July 6 to August 25.

Meteorological instruments were lent by the Air Ministry, and an arrangement was made whereby synoptic reports could be sent through the Norwegian station at Jan Mayen. One should here acknowledge the courtesy of the observers in listening for our faint and irregular transmission, and for occasionally forwarding other messages for us. Reports were sent at 6.40 and 17.40 G.M.T. for inclusion in the morning and evening international charts. We were also able to send ice reports on the way through the pack.

From Jan Mayen northward the weather was prevailingly cloudy with light west to north winds (force 1–3) and a good deal of fog. Near the Greenland coast (July 11) the wind rose a little from south, with a falling barometer, but no precipitation. The raw fog which is a prevailing feature of the coast in summer hindered our landing till the evening of the 12th. The 13th (Sabine Island) was a brilliant day; the wind light from east or south-east during the day, veering to west in the evening; the 14th exactly similar, but with a light sea mist drifting in about noon. From the 15th–20th this sea fog was very persistent; the winds very light and variable in direction. On the hills above 1000 feet the weather remained brilliantly fine as a rule, with light land breezes. This type of weather was met with again at Mackenzie Bay a month later; it appears to be analogous to the cool mists of the east coast of England at times when the inland weather is brilliantly hot.

In passing it should be mentioned that the drift of the upper clouds when observed was almost invariably from the west or north-west, and the weather was settled, with two exceptions.

The first of these was the storm of July 23–26. Late on the 22nd evening fine and sunny till $22\frac{1}{2}^h$ (G.M.T.); then A. St. developing and "false cirrus" moving from S.E.—wind E. 1; T. 35°.

23rd. At 3^h, wind N. 4, gusty: nearly overcast and temperature risen from 35° to 39°. 9^h wind N.E. 6, squally, sleet beginning. 11^h wind at camp N.E. 8, squally, 34°, continuous sleet. 13^h wind N.E. 10; heavy sleet and snow, snow lying down to 400 feet. Wind force 9 to 10 rest of day, sleet and snow with one short interval.

24th. 12^h wind N. or N.E. force 8; raining all day, temperature 39·7°, and wind force 7 at 19^h, rising again to N.E. force 11 about 22^h–24^h. Heavy rain and occasional sleet.

25th. Wind N.E. force 8–9 all day to 18^h, rain; becoming N. 7 and slightly colder with a little snow. Wind increasing again at 23^h to force 8 or 9.

26th. Wind N.E. falling gradually to force 5 at 18^h, and becoming almost calm by 23^h.

During this gale the ship rode in the lee of Little Pendulum Island, with rather less wind than at Germania Havn.

This storm seems to be very typical of the East Greenland coast. The sudden beginning and ending and the long duration are characteristic of the storms noted by the German Expedition: judging by their figures the duration of this example, about seventy-two hours, is rather longer than the average. It is noteworthy that Clavering records a similar experience in September.

There was a second break in the weather from July 28–August 1, the ship being then in the inner part of Gael Hamkes Bay, about 30 miles from the seaward coasts. "Ragged Ci. St. and A. St. approaching" on the evening of the 27th was followed by overcast threatening weather next morning (28th),

with rain later in the day, temp. 38°, wind E.N.E. 4; the 29th was fine; again on the 30th light rain nearly all day, barometer rising, wind W. and temp. 45°. A fine interval was followed by a rainy evening on August 1, light rain falling on a wind backing from S.E. to E. force 3; temp. 40°.

The weather from August 2 onward was exceedingly fine; the whole journey up and down Franz Josef Fjord and the reconnaissance towards Petermann Peak were carried out under almost cloudless skies. The barometer rose steadily as we went inland, and remained high and varying little during the return voyage till the 19th. The evidence of snow drifts and glaciation suggests that precipitation diminishes considerably going inland; and along the coast it increases southward. The warmth and shelter of the inner fjords give rise to a flourishing vegetation, and the snow-line reaches 4500–5000 feet on north slopes, 6000 feet on the southward slopes.

On the return voyage sea-mist lay in patches up the fjord 30 miles inland, and later (13th–17th) fog was very persistent in Mackenzie Bay; at times rising and forming a cloud sheet a few hundred feet above and giving a limited visibility for survey work. Above 2000 feet, however, everything was invariably clear. From the 18th–20th clear fine weather on the coasts, with light S.E.–N.E. winds; barometer falling generally. Fog at the mouth of Vega Sound early on the morning of the 21st, drifting seaward; possibly a "land-breeze" effect in that locality; it was followed by another very brilliant day, but early the next morning, the 22nd ("cloudy for first time for three weeks") A.St. was observed approaching from north-east, and a fresh north-east wind arose, but only lasted some hours. The wind fell later, and a slight drizzle followed lasting all day, turning at night to wet snow on a slight westerly wind (Liverpool Coast). In Scoresby Sound (morning of 23rd), although the barometer had risen, the wind was freshening from north-east with sleet and raw drizzle. The voyage to Iceland was rough, a high wind or gale from N.E. to N.N.W. through the 24th, fine with backing wind on the 25th.

Whether this latter disturbance would have shown itself to the northward, in the Sabine Island region, is uncertain. The comparison of the German records there with those of the *Hansa* party drifting on the ice off the Scoresby Sound region show several instances of storms recorded by the one party and not by the other. The Sabine Island blizzard, as it may be called, presents several features of interest for further investigation.

J. P. Koch, in his remarks (*Meddelelser om Grønland*, **46**, pp. 451 *et seq.*) on the climate of Danmark Havn (76° 46′) and northward, points out a similar prevalence of easterly coast breezes in the summer, as a rule not reaching more than 1000 feet above the sea. The strongest winds are from between west and north, and do not seem to reach the strength observed at Sabine Island. When observations are available from Scoresby Sound they should provide interesting results.

On Sabine Island the radiation from the stony ground was very noticeable, and the difference between an aspirated thermometer, or one hanging in the breeze, and one sheltered from the breeze might reach 3° F. or more. All temperatures quoted here are taken swinging in the wind, by Assmann psychrometer, or on the windward side of the ship. The "fine day" temperatures on Sabine Island ranged from 29° to 46·5°: during foggy weather daytime temperatures ranged between 32° and 38°. Elsewhere one may quote: 47·5° at 1200 feet above Gael Hamkes Bay, afternoon; 48·5° on ship crossing bay, afternoon. Franz Josef Fjord: 51° at Eleonoren Bay on ship, noon; 53·5° on

ship at Kjerulf Fjord, afternoon (the Swedish party recorded 59° here on land). In mountains: 48° at 3100 feet (morning), 44° at 5000 feet (afternoon) and 40° at 7640 feet (afternoon). Midnight, at 6840 feet, 24·5°. Musk-ox Fjord: 54° in mid-afternoon. In the sheltered inner fjords the temperature on land must reach 65° frequently, with a daily range of temperature in summer, while the sun is up, of about 20°.

Of other phenomena, halos were of frequent occurrence. The visibility was scarcely ever noted as less than "excellent," unless it was foggy or raining. Mirage and extraordinary refraction effects at sea were frequent; on one occasion Little Pendulum Island (2000 feet) was seen from the ship's deck 150 miles away. The planet Venus was first visible on August 18 (in 74° N.), and three nights later, *i.e.* ten or twelve days after the sun's first setting, it was not possible to read in the open at midnight. Twilight phenomena were very noticeable in the clear atmosphere.

APPENDIX V.—GEOLOGY

J. M. WORDIE

The main geological divisions are six in number: Quaternary, Tertiary basalts, Mesozoic beds, Old Red Sandstone, Lower Palæozoic, and Archæan.

Speaking generally, the most recent rocks are found on the outer coast, and older rocks are met with as one proceeds westwards into the fjords. As the expedition worked mainly on the outer coast, this has meant an undue preponderance of Tertiary basalts among the collections.

1. Archæan was met with in two distinct areas: at Clavering Island and Wollaston Foreland; and again at the head of Franz Josef Fjord. The former area represents the southern limit of the Archæan belt which stretches from 74° to 80° N.: it is separated by a broad belt of Palæozoic rocks from the second region, whose main extension is southwards to Scoresby Sound. The latter locality presents the greatest contrasts: it includes, for instance, not only gneisses which would be correlated with Lewisian in this country, but also a more complex series of sedimentary schists, probably pre-Cambrian in age and equivalent to the Scottish Dalradian. In this connection the striking recumbent folds on Riddarborgen may be put on record.

2. The determination of Lower Palæozoic beds is due to Nathorst, to whom we also owe the recognition of the equally widespread Devonian or Old Red Sandstone above. The former consist mainly of brightly coloured limestones and sandstones in rapidly alternating series. The precipitous ice-free cliffs so frequently found in these beds constitute some of the finest scenery in Franz Josef Fjord, of which the horizontally banded cliffs of the Devil's Castle may be cited as a special instance. It has not been possible to date the beds more closely than as Lower Palæozoic, and until this can be done they might conveniently be named the Franz Josef Beds. Near Cape Stosch erratics were found strongly resembling Cambrian quartzites from the north-west Highlands of Scotland: apart from that the evidence points to Ordovician or Silurian age.

A point of importance is the evidence for these rocks being overthrust westwards over the Archæan. If the thrust found near the north end of Antarctic Sound can be further established it will prove the existence of Caledonian movement in an entirely new region. Lower Palæozoic rocks are no doubt represented on Canning Land south of Davy Sound; Otto Nordenskjöld, the only geologist to visit the latter area, unfortunately was not

familiar with Nathorst's type areas farther north, but the correlation will no doubt result from Lauge Koch's work this year.

3. Devonian rocks rest unconformably on Lower Palæozoic throughout Franz Josef Fjord. They consist on the Gauss Peninsula of red and grey sandstones thrown into very wide gentle synclines and anticlines. The basement bed is an exceedingly coarse conglomerate well seen just west of Cape Ovibos. The upward limit of the system was not determined, being in all cases masked by Tertiary igneous activity; it might be looked for round the head of Musk-ox Fjord. Devonian rocks are not definitely known farther south than Traill Island, but, as in the case of the older Palæozoic limestones, may be confidently looked for on the south side of Davy Sound: specimens collected by Nathorst at Antarctic Havn appear to be Devonian rather than Triassic.

4. One of the most important geological discoveries was the finding of a belt of white and red sandstones and shales with characteristic Lower Trias ammonites forming the mountain range on the south side of Gael Hamkes Bay from Cape Stosch to Cape James: they appear also to occur west of Loch Fyne. Many Jurassic and Cretaceous horizons are already recorded from 76° and 77° N., but this is the lowest Mesozoic marine series either in Spitsbergen or Greenland. Shales of unknown age, but probably Mesozoic, build up the east portion of Clavering Island and much of Wollaston Foreland from Tiroler Fjord to Cape Berlin: they are frequently broken across and hidden by basalt sills of Tertiary age, and it has thus been generally assumed that these regions present a development of Tertiary lavas and intercalated sediments. The relation of the Mesozoic rocks to the Archæan horsts has not been clearly made out. Between Devonian and Trias there is an interval about which nothing decisive is known. Below the Trias at Cape Stosch, however, is a limestone with brachiopods, regarded as more likely to be Upper Carboniferous than Permian; if this is so, certain barren red sandstones, 3000 feet thick, with similar dip and strike, at Cape Oetker at the west end of Clavering Island may be Lower Carboniferous.

5. The Tertiary igneous rocks may either be lavas proper (Little Pendulum Island, Jackson Island, and Ladder Mountain) or intrusive sills. The latter are often intercalated between the lavas, but also occur quite independently as thick masses and widespread sheets in regions where no effusive rocks occur. The extreme north part of Sabine Island and the whole of Wollaston Foreland is interpreted as a region of Mesozoic rocks smothered by intrusive sills. The bulk of Sabine Island, however, and its neighbour Little Pendulum Island, constitute a clear volcanic centre. This is also the case for most of Hold with Hope (the Triassic syncline of Cape Stosch being overlain by sills and lavas) and the Giesecké Mountains farther west. On the other hand, no lavas proper were found on Geographical Society Island, but only massive sills which pass out to sea and make navigation extremely dangerous. The sills pass over into Traill Island at Cape Palander, and no doubt form the Craig Islands in Mountnorris Inlet. At Cape Parry, however, and Cape Young, the rocks collected are intrusive syenites of alkali nature, but possibly also of Tertiary age.

6. The present-day snow-line is as high in places as 5000 feet, but there is abundant evidence, at least in Gael Hamkes Bay, of a much more intense glaciation, as shown by erratic boulders 2500 feet above sea-level on Clavering Island. Raised beaches are never prominent, but recent emergence is clear both on Sabine Island and in inner Franz Josef Fjord at Eleonoren Bay.

APPENDIX VI.—THE ESKIMO REMAINS.

D. McI. JOHNSON

As far as can be made out, Eskimo have been extinct in North-East Greenland at least since 1870, having died out or been compelled to migrate owing either to change in climatic conditions or to shortage of game. The only occasion on which they have been seen was by Clavering in 1823 on the south coast of the island to which his name is now given.

North of Little Pendulum Island a comprehensive survey of the Eskimo remains was made by the Danmark Expedition, led by Mylius Erichsen, in 1906–8. The observations form vol. 44 of the *Meddelelser om Grønland*, a careful report on the sites by Bendix Thostrup being followed by an exhaustive description of the implements and artefacts by Thomas Thomsen.

Our work was confined to the coastal region south from Little Pendulum Island as far as Davy Sound (72° N.), and it was our object to try and apply the same minute investigation to this part of the coast as had already been so successfully done by the Danes farther north. The existence of Eskimo settlements in the region had been previously mentioned by Koldewey (1870) at Sabine and Clavering Islands, by Nathorst (1899) in Franz Josef Fjord, and by Scoresby (1822) on Traill Island. No detailed survey, however, had yet been attempted. The good fortune of the expedition made this possible, though on account of the short summer season (six weeks) it was of necessity somewhat cursory in places. A number of new facts have been brought to light.

It will be advisable, for the sake of those not familiar with the nature of the remains, to include a general description of them together with that of the work more particularly done by the expedition.

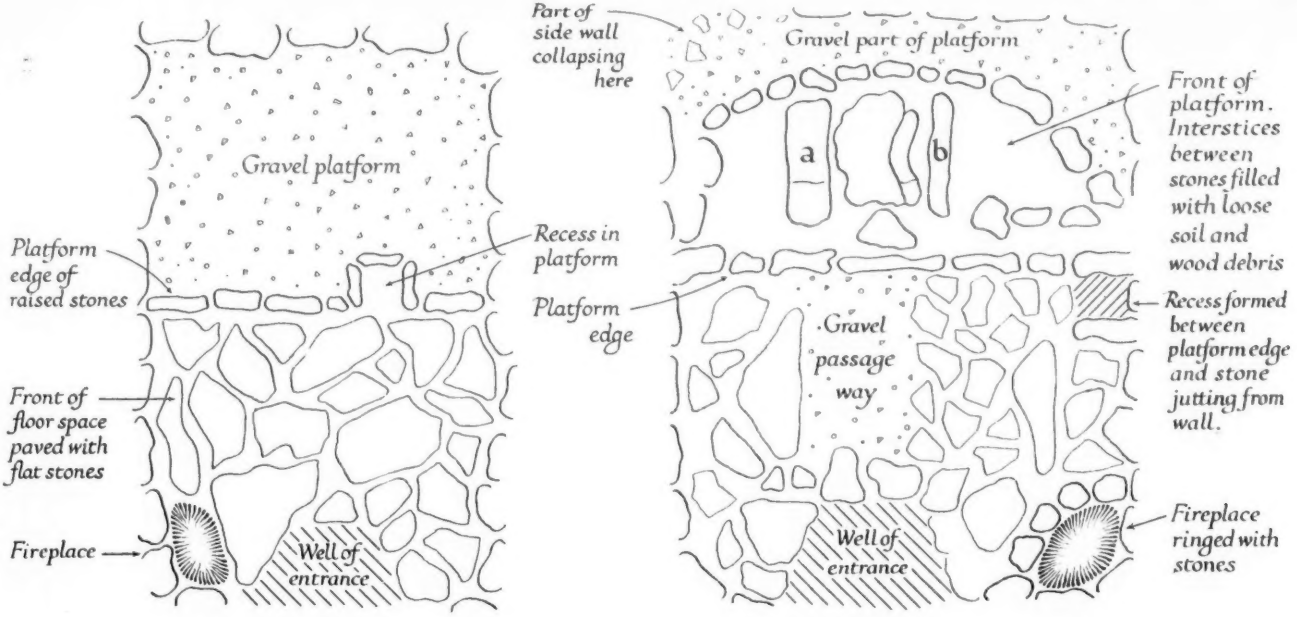
In winter the Eskimo occupied huts excavated in the ground, and roofed in with turf and wood, while in summer they lived in tents on the sea-beach. Remains of both these forms of dwelling are found, the former as ruins of the huts themselves, the latter marked by the rings of the stones which were used to weight down the flaps of the tent.

The winter huts are usually built on a slight slope; the roof is of light structure, formed of turf supported by wooden beams, and its level is slightly above the lie of the ground; the side walls are built up with stones. The huts vary somewhat in size, but average 8 feet in width by 10 feet in length, and were probably about 3 feet 6 inches high. As regards the condition of the roof and the exact height of the hut, it is difficult to ascertain the exact facts, as in every case the roof is now found collapsed on to the floor.

The entrance is by an underground passage way 10 feet long, which enters 2 feet below the general level of the floor, and forms a small well. In every case the actual door is roofed across by a large flat stone which gives a characteristic appearance to the hut as viewed from behind. In all except the most recent huts this lintel is found collapsed inwards together with the front wall, thus blocking the passage way.

Several huts were found in excellent condition and were successfully excavated by the expedition. In the process of excavation large numbers of bones would be found at every step, but very little apart from these: the bones had either been left lying about on the floor or had fallen in with the roof. They were found strewn in every direction both outside and inside the huts, and often even wedged in between the cracks of the wall.

After removing the roof *débris*, by careful scraping the floor-plan was accurately made out in four huts. In three of these the plan was identical (see


Gravel platform
Platform edge of raised stones
Front of floor space paved with flat stones
Fireplace
Well of entrance
Part of side wall collapsing here
Recess in platform
Platform edge
Gravel part of platform
a
b
Front of platform. Interstices between stones filled with loose soil and wood debris
Gravel passage way
Recess formed between platform edge and stone jutting from wall.
Well of entrance
Fireplace ringed with stones
Scale of feet: (approximate)
0 1 2 3 4 5 6

1. *Typical hut*

2. *Hut excavated at Kjerulf Fjord*

diagram 1), with minor variations; the diagram, however, gives the general plan.

The shape of the best-preserved huts is rectangular; but older specimens vary considerably in outline, sometimes approaching the pear shape. To the front is the well of the passage entrance, while the front part of the floor space is paved with flat stones; in one of the front corners there is an unpaved hollow, the fireplace. The back half of the floor forms the platform or sleeping-place of gravel raised 3 or 4 inches above the front part and sloping slightly upwards to the back wall. There is often a raised platform edge of stones. There is a small recess in the platform, the floor of this being at the same level as the front of the floor space of the hut, the side walls formed by upright flat stones. This place was always found packed with bones and wooden *débris*, and apparently was roofed in with wood and used as a small cupboard.

In the fourth hut, a large one excavated at Kjerulf Fjord, a similar but more elaborate arrangement was found (Diagram 2). In the front of the floor a passage way of gravel runs down the middle from the entrance as far as the platform edge, dividing the paved floor space into two. The fireplace was to the right of the entrance and edged by stones. Behind this was a small recess formed by raised stones jutting out from the wall. As regards the platform, only the back part was formed of gravel, the front border being crescentic with concavity forwards. There was a well-constructed platform edge, and behind this were a number of stones in definite arrangement (see diagram). Most prominent were two long flat slabs, *a* and *b*, bounding a space where several smaller flat stones were piled on top of each other. The interstices of this space between the platform edge and the gravel at the back were packed with loose soil and wooden *débris*, in which several implements and ornaments were found. It seemed as though the front of the platform was formed by wooden beams supported on these stones, and that the objects found had dropped between the cracks in the wood and so been lost and forgotten. Nothing was discovered in any other part of the hut, though it was in excellent condition and obviously of recent construction. There was a well-made passage-way through which one could crawl, the side walls and roof being formed by large flat slabs of stone.

As regards the tent rings, the regularity in formation of these is extraordinary. When striking tents the Eskimo did not bother to move the stones farther than just off the flap of the tent, with the result that perfectly definite rings of stones were left to mark each camping site. They may, of course, have purposely left the stones like this in order to be able to return to the same place the following summer.

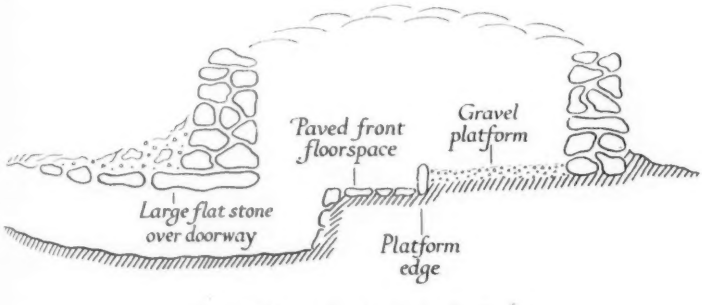
The diameter of the tent rings is usually 10 feet, but varies between 6 feet and 15 feet. They are circular, square, or oval in shape. The stones vary considerably in size, no doubt according to the permanency of the intended occupation of the site.

On the sites that were occupied for any space of time, the inhabitants divided off the back of the ring with a line of stones to form a platform. This line of stones was left in position after removal of the tent. In the case of square tent rings, the platform edge may run either from side to side or else diagonally across the floor. The interior is always levelled and cleared of stones, in contrast to the surrounding beach.

In rare instances two large stones on either side mark a doorway to the tent, and there is a definite passage way. Very often there is also a paved area forming a lamp-place in the middle of the floor. Additions to the rings are often

seen, as at Falsche Bay, where there is a small enclosed space adjacent. In one large ring at Cape Broer Ruys an enclosed space was found inside the ring itself. The stones forming the tent rings are in every case from the surrounding beach. On the outer coast, where basalt of dull appearance is the commonest rock, there seemed to be a tendency deliberately to pick out bright pieces of sandstone and gneiss to form part of the ring.

The winter huts were found in colonies of varying number; in several places there were only two or three houses, *e.g.* Little Pendulum Island (two), Germania Havn (three), Cape Weber (two), Kjerulf Fjord (four), and Cape Simpson (three), while in others there were many more. Two large colonies were found on the south coast of Clavering Island, there being eighteen huts in the one at



3. *Cross-section of winter hut*

Eskimo Bay; a third large colony at Eleonoren Bay on the north bank of Franz Josef Fjord had ten huts. The age and condition of the houses varied considerably, and in the large colonies different generations of huts were seen lying side by side, the oldest ones being merely shown by a circular mound with a gap for the passage-way.

In the already-mentioned investigations of the Danish Expedition north of 75° it was claimed that there were three definite periods of hut building corresponding to separate immigrations of Eskimo. Our own observations on the colonies of huts on Clavering Island and at Eleonoren Bay in no way support this conclusion. Huts of apparently all gradations of age were found, from recent ones in good condition to the very old ones just mentioned. It seems probable that as soon as a hut became too dilapidated for further use, a new one was built close by, in many cases the stones of the old one being used in the new construction; this would cause the space occupied by the old one to be filled in more easily. It was also stated by the Danish observers that the very old hut sites were not found south of 77° N., it being assumed that they were the remains of a tribe which had migrated along the north coast and never reached farther south than this point. Similar old huts, however, were found in several places by the present expedition even as far south as Franz Josef Fjord (lat. 73° 30′ N.). There is thus no reason to believe that the people who built these old huts are not the same as those who constructed the most recent ones.

The colonies of huts are generally found on the north side of the fjords,

i.e. facing south. This may have been due to desire for shelter from the prevailing north wind, and perhaps also to take advantage of the more open water under the lee of the land. Tent rings, on the other hand, have not the same limited distribution, and are found both inside the fjords and on the more exposed outer coasts. Tent rings and winter houses may also occur side by side, as at Germania Havn, at Cape Stufenberg on Little Pendulum Island, and at Cape Simpson, at all of which places there are a large number of rings in addition to the few winter houses.

The tent rings are most commonly found in groups of thirty or forty; and there seem to have been definite camping-grounds to which the Eskimo returned season after season, no doubt in many instances using the same stones every year. The largest settlements were found on Walrus Island and on the Bass Rock. There is also a large camping-ground on the south part of Hold with Hope between Mackenzie Bay and Cape Broer Ruys.

Besides the winter huts and tent rings, another form of habitation was isolated shelters of which trace is left as horseshoes of stones measuring 2 or 3 feet across. These are usually found either solitary or in small temporary camping-places where there are three or four tent rings only, and may mark the camping site of a single hunter. Many other interesting forms of stone remains in the form of wall shelters were found on Walrus Island, the nature of which it was difficult to make out in the short time available. The remains on that island afford excellent opportunity for future research.

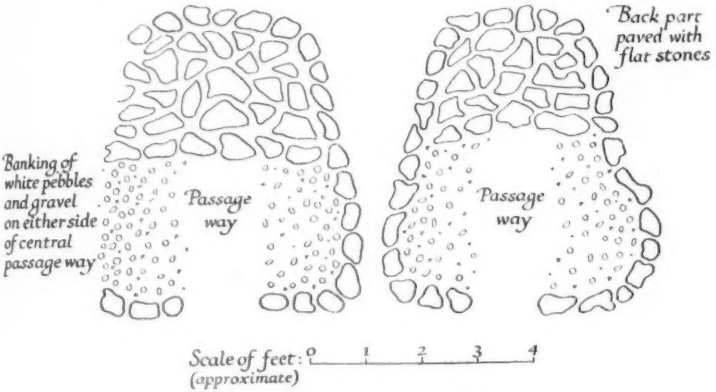
Other forms of stone structures were found in association with the colonies, most important being the meat depôts where the flesh was stored. These varied from the small heaps of stones used for temporary preservation, to the large permanent depôts where the meat was kept for some time. The latter were found either as round hollow cairns in the open or built up in nooks in the rocks with large flat stones. In one case at Eleonoren Bay some reindeer hide was found still in one of the cairns. It may be noted that Musk-ox heads with the flesh still adhering were found at Eskimo Bay.

Graves were found near the winter settlements, generally among rocks or on higher ground at anything from 100 to 500 yards away from the colony. In comparison, however, to the number of huts surprisingly few graves were found; this may be accounted for either by the fact that all but the strongest were broken down and the bodies removed by animals, or that only a minority of the dead were buried, others being placed in the sea or left exposed. The graves are in the form of oblong hollow cairns 6 feet long by 3 feet wide, built up 2 or 3 feet above the ground and roofed in with stones supported on beams of wood laid across from the side walls.

The internal measurements of one grave (at Little Pendulum Island) were 3 feet long by 1 foot 6 inches wide. The body in this case was buried in a small depth of earth and gravel in a doubled-up position, and the grave structure built over it. Another in similar condition was seen at Eleonoren Bay. In one of the graves at Eleonoren Bay several trinkets were found beneath the chin of a female skeleton; this, however, was the only instance of our finding any objects in graves.

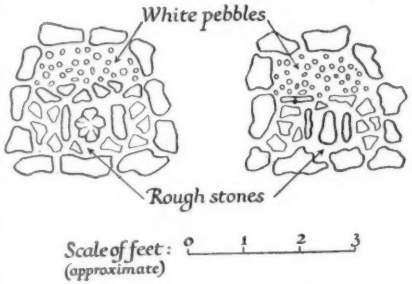
Fox traps consisted of an oblong box formed of stones, with a pointed stone wedged into the end wall, on which was spiked a piece of flesh. This was connected by a thong to a triangular flat stone which formed a falling doorway. When the fox snatched the meat the thong was tugged so that the flat stone was pulled down and the door closed. The animal was extracted by lifting off the roof stones.

In addition to the above dwellings and other structures, all of which have been described in Thostrup's article in the *Meddelelser*, some stone formations were discovered in more than one place of which no detailed mention, so far as I am aware, has previously been made. These took the form of a mosaic of stones on the ground as in diagram 4. A compact outer border of stones en-


Back part paved with flat stones
Banking of white pebbles and gravel on either side of central passage way
Passage way
Passage way
Scale of feet: 0 1 2 3 4
(approximate)

4. *Mosaics at Eleonoren Bay*

closes a space, the back part of which is paved with flat stones; in front, either side is slightly banked up with white pebbles between which there is a clear passage way, and in the front wall there is often a gap for a doorway. These mosaics were found at Cape Borlase Warren, Cape Mary, Cape Weber, and Eleonoren Bay. They were nearly always found two together side by side, the general plan being in every case the same, though variations occurred in detail. The measurements of the majority were approximately the same in each case, 6 feet long, 3 feet broad at the back, and 4 feet 6 inches broad in front. A photograph of what seems to be a similar formation at Rypefjeldet (lat. 76° 56′ N.) appears in the *Meddelelser*, though it is not recognized in the text as something new, but is described as a shelter. Several smaller mosaics of somewhat similar arrangement were found at Cape Weber and at Eleonoren Bay. In place of a passage down the front, however, there is an enclosed space between the pebbles occupied by a large white stone or pair of stones (diagram 5).



5. *Small mosaics found at Eleonoren Bay*

The significance of these mosaics is doubtful. They seem much too carefully arranged to be merely children's playthings, as has been suggested. Their design, it should be noted, resembles roughly that of winter huts, with paved platform space at the back, and passage way down the front; the

arrangement of stones in the smaller ones, indeed, is very similar to that found (and mentioned above) in the front part of the platform in the hut at Kjerulf Fjord. Is it possible that they have some religious significance?

Another point of interest was the finding in the floor space of one of them of flat pieces of yellow limestone with intersecting grooves which had evidently been used for sharpening bone pins.

With the exception of pieces of sledge runners and a few other objects found on the ground or picked up among the driftwood, the objects and implements brought back by the expedition were all derived from the excavation of the huts. It is impossible to describe them fully, but of chief interest are spear heads and arrow heads of slate, and arrow heads and harpoon heads of bone. We also found bone trinkets and ornaments, including the model of a duck, and a carved wooden doll. It may be noted that three harpoon heads with rough iron blades were found, one on Little Pendulum Island and two in the hut in Kjerulf Fjord.

From their remains a rough picture of the Eskimo life and of their seasonal migrations can thus be obtained. The bones which are found lying around in every direction indicate the animals they hunted: these include bear, seal, and hare round the tent rings; and bear, fox, hare, and reindeer near the winter huts. Reindeer have now been thought to be extinct for some years in East Greenland owing to attack by wolves; it is just possible that the growing scarcity of the animal on which they relied largely for their fresh meat in winter may have been the main cause of the disappearance of the Eskimo.

The archæological results of the expedition can therefore be summarized:

(1) General survey of distirct from Little Pendulum Island to Traill Island. Parts where remains are thickest are the south coast of Clavering Island and the north bank of Franz Josef Fjord, for winter huts; and Walrus Island and Bass Rock for tent rings. In the fjords inside Clavering Island nothing was found after close investigation. Large number of remains in Cape Simpson region, no doubt, but only time to investigate a few (three winter huts and thirty to forty tent rings towards the north-east corner).

(2) Discovery of floor plan of winter huts.

(3) Description for first time of mosaic formations.

(4) Collection of large number of implements and other objects, picked up on shore or found in excavation of winter huts.

(5) Four skulls and one complete skeleton brought back for investigation.

APPENDIX VII.—THE PENDULUM OBSERVATIONS

G. MANLEY

The instrument used was the Stückrath pendulum apparatus belonging to the Science Museum. Since 1923 it has been lent to the School of Geodesy at Cambridge. The pendulums were swung at Cambridge before the voyage, and after return.

Sabine Island was reached on July 12, and a site chosen for observing on the east side of Germania Havn. The observations were carried out in two Whymper tents 7 feet by 7 feet by 6 feet high, placed facing one another with the pendulum stand at one end and the flash-box, chronometer, and wireless set at the other. The stand itself rested on a small firm pillar built upon the bare ground, and the flexure corrections, so often a trouble where a newly built pillar is used, were unexceptionable. The chronometer, by Mercer, was lent by the School of Geodesy; its rate throughout the observing period was good, in the circumstances. The wireless installation was entirely due to

Barnett, who with White gave invaluable assistance during the course of the observations.

Temperature variations in the small observing tents would have been bad, and some sort of wooden screen would have been necessary, had it not been for most fortunate weather conditions. A persistent sea mist lasted through four of the five critical July days on which the pendulums were swung, so that the range of temperature was very small. Each pendulum was observed over a number of periods from 8 a.m. to 12 midnight (G.M.T.): the programme was a heavy one, but went through with only one hitch, when the Nauen time signal failed on the fourth day, necessitating another day's work. The swings were disposed through the day in such a way that clock rates calculated from either Bordeaux or Nauen signals could be used in the reduction of the observations.

By the 22nd the programme was finished, and as the mist had cleared the opportunity was taken of observing the latitude and longitude of the station. It lies about three-quarters of a mile nearly due east of Sabine's reputed position near the Eskimo village on the west side of Germania Havn. It was hoped to repeat the observations for position on the 23rd before departure. Any thought of further work was dispelled, however, by the sudden onset of a strong north-easterly gale on the morning of the 23rd, accompanied by heavy sleet. The pendulum tents, being very exposed, were wrecked, and the rest of the camp withstood the rising wind little longer: at noon it was estimated at force 9, increasing. The storm lasted over three days, as described elsewhere. The instruments were recovered undamaged, with the exception of two broken thermometers. As it was necessary to leave as soon as the storm had abated, the observations for position are incomplete. A cairn has been erected over the observing pillar, which should form a permanent mark for future reference.

The following extract from the Report of the Committee for Geodesy and Geodynamics, dated 14 May 1927 (Cambridge University Reporter, 7 June 1927) gives the brief result of the pendulum observations:

"Accepting the determination referred to in last year's Report, which gave 981·265 cm./sec.^{2} as the value of g in the Pendulum House, Manley's observations establish a difference of 1·621, and we have as the value of g on Sabine Island (lat. 74° 32′ 19″), 982·886. The station was 25 feet above sea-level, so that the value of g at sea-level is 982·888.

In order to compare this with Sabine's results we make use of the following data taken from the published accounts of his work:

(1) From *Experiments to determine the Figure of the Earth*, 1825.

No. of vibrations in 24 hrs.

at Mr. Browne's house in London	86159·79	Pendulums nos. 3 and 4.
on Inner Pendulum Island	86230·44	

(2) *Phil. Trans. of the Royal Society*, 1829:

at Mr. Browne's house	85969·32	Pendulum no. 12.
at the Royal Observatory, Greenwich	85969·80	

The value of g at the Royal Observatory based on the Potsdam determination of 1906 is 981·186, whence we deduce, by means of the above figures:

g at Mr. Browne's house $= 981{\cdot}186 - 0{\cdot}011 = 981{\cdot}175$,
g on Inner Pendulum Island $= 981{\cdot}175 + 1{\cdot}610 = 982{\cdot}785$.

The value of g at sea-level in latitude 74° 32′ 19″ calculated by Helmert's

formula of 1901 is 982·849. Sabine's value falls short of this by 0·064 and Manley's value exceeds it by 0·039.

At the large majority of island stations the observed value of gravity exceeds the value deduced from the formula, and we may therefore say that Manley's result is of the same type as those obtained by other observers on other islands.

It is known that the earlier pendulum observations, both those of Sabine's day and later series also, down to the invention by Mendenhall and von Sterneck of the type of apparatus now in general use, were liable to considerable error, though it is difficult to discover a cause adequate to explain this error.

It is perhaps of sufficient interest to deserve mention that the pendulum apparatus which was taken to Sabine's station by Mr. Wordie's Expedition is the same which was taken by the Scott expedition to the Antarctic: these pendulums have therefore been swung both at one of the most northerly stations and the most southerly station that have ever been occupied.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: When I call upon Mr. Wordie to give you the results of the latest expedition to East Greenland I shall call upon one who is very intimately connected with this Society. He has led two expeditions, I will not say into that very remote and hardly accessible region, East Greenland, because the first never got there; but the second was more fortunate. Everything depends, as you know, on that ice-bound coast, upon the particular conditions of a particular year. This year he was fortunate. He undertook these expeditions after very considerable Arctic experience. I need not remind you that the post of leader of expeditions such as these to East Greenland is one of peculiar responsibility. Mr. Wordie will tell you how he had to come on more than one occasion to momentous decisions. For example, whether they should or should not attempt to reach the high mountains which were seen inland. Those at any rate who were present at the paper on the Mount Logan expedition will agree with me that, considering the enormous difficulties of mountain ascent in high altitudes, his decision was obviously right. But perhaps the more important decision that a leader of such an expedition has to make is when to drop it; that is to say, when to begin to make for home for fear of being enclosed in the ice. Altogether, he has a remarkable tale to tell you, and I will ask him to begin to tell it you at once.

Mr. Wordie then read the paper printed above, and a discussion followed.

Lieut. P. F. WHITE: It is difficult for me to add anything to what Mr. Wordie has said, because he has covered most of the points. There is, however, one to which I should like to refer. He said that the musk-ox was a tame and quiet creature. I will tell you a story which some of the other members of the expedition do not believe. A musk-ox can see only about 10 yards; he goes entirely by smell. Some members of the expedition were out walking one day, and on turning round saw a musk-ox charging at them. That's a fact, though some will not believe it. Subsequently, two members say that they went up and stroked a musk-ox. That I do not believe.

With regard to the existing maps of East Greenland, we took them for what they were worth. They were made, as Mr. Wordie said, from great distances; Scoresby's map was made from a distance of about 30 or 40 miles. In the clear air of East Greenland it is possible to see an extraordinary distance, and a large number of the places Scoresby marked as capes are nothing more nor less than mountains. It is remarkable that, considering he spent most of his

time up in his crow's nest in extremely cold weather, he should have produced such extraordinarily accurate results as he did from such a great distance. Others have been there since, but he was the first Britisher, and made a map on which others have improved. I hope somebody else will go and finish what has not yet been done.

Dr. D. McI. JOHNSON: I am afraid there is not very much I can add to the excellent account Mr. Wordie gave about the Eskimo. We were very fortunate indeed with the weather, so that we were able to cover a large amount of ground. In all, 66 huts and over 200 tent rings were found, and we were able to make quite good investigations of them. It was contended by the Danish expedition which made investigations farther north that there were three different periods of immigration of the Eskimo, with the winter huts showing the corresponding gradations of age. We could not find support for that theory.

The only other really interesting Eskimo remains were the graves, and there were very few. We found only twelve, and they were near the huts. There were sixty-six huts, but there were only twelve graves to correspond. That is rather striking, as there must have been more than twelve Eskimo living in those sixty-six huts. It seems they must have had some different method of disposing of a corpse. From the graves we got four skulls and two complete skeletons, the latter always found buried in a doubled-up position; these are now at Cambridge. When we took them on board it caused somewhat intense feeling amongst certain members of the expedition who were inclined to be superstitious, and a storm which happened just after we got the first skull on board was attributed to its presence.

Mr. G. MANLEY: Mr. Wordie referred to the extremely fine weather during the greater part of the expedition, and indeed it was really remarkable, breaking only twice. On one occasion the weather was rather unsettled, but on the other it was more than that. This occurred at Sabine Island when two of the party were left there and the ship was exploring the coast-line of the island while the pendulum observations were being carried on. It was intended that the ship should pick us up on July 23, and the programme was just about to be completed by taking some longitude sights. Any hope of that was dispelled when I awoke on the morning of the 23rd and found, instead of the usual fine weather, that the wind was blowing rather briskly from the north-east and there was a little sleet. I went off to sleep again, but when, two hours later, I looked out once more the wind had risen to a strong gale and, to my horror, the observatory in which the precious pendulum apparatus was kept was wrecked. The wind had risen very rapidly and the tents had been overturned. There were only the two of us on the island. We rushed down and, after about four hours, got all the material almost undamaged into a hut which providentially had been built by a Danish party who wintered there about six years ago. What we should have done without it we did not know. We retreated into the hut, and the wind blew incessantly with gale force or more for seventy hours, and then dropped suddenly, when, much to our delight, the ship arrived. We spent the time in the hut cleaning it up, for it was in an appallingly dirty condition after five years. Luckily there was some coal outside the hut, and we were able to cook our food. We decided that the party on the ship were not going to be heroes rescuing marooned members of the expedition, so we welcomed them very quietly, and when they came into the hut, much to their astonishment, we made them all sit down, after wiping their feet, and gave them afternoon tea! The storm was remarkable for the

way in which it arose and blew for nearly four days incessantly with either rain or sleet; sometimes with snow driven hard from the north-east. Apparently such storms are typical of the north-east coast of Greenland in that latitude, but farther south the weather is much more unsettled in the ordinary way, subject to the prevailing Icelandic depression. Farther north the weather is prevailingly fine except for these remarkable storms, and it is possible that further study of that type of storm may cast a good deal of light on the meteorological problems of the Northern Hemisphere, more particularly as they affect Norway and our own islands.

Dr. H. R. MILL: I have really no claim to speak about Greenland except that it is a part of the world which has been of lifelong interest to me. I believe that Greenland was the very first piece of the Earth's surface beyond the seas of which I ever heard, not, as you might imagine, from the familiar hymn, but from the fact that just one hundred years ago my father completed his education as a medical student by going out as surgeon of a whaler, as the custom was in those days, to learn self-reliance by spending a summer off the coast of Greenland. From my earliest infancy I heard his stories of that adventurous season, followed up by the history of the Franklin search. Later I became acquainted with old Arctic heroes who on a night like this used to fill the front seats and were apt to treat young explorers, and especially prospective explorers, with cold criticism enough almost to chill the ardour of such ebullient young men as we have had the delight of hearing to-night. It seems strange that none of those veterans of the Arctic remain with us, so hale were they as octogenarians, but it is encouraging to find the younger generation carrying on the work with equal ardour and with more system, above all with a much more scientific grasp of the real problems.

It is not without reason, I think, that the Scott Memorial Institute for the encouragement of Polar research has been established in Cambridge from which this expedition went out, and we must all admire the solid, quiet, non-advertising way in which these Cambridge Polar students did their work and told their story without any resort to sensational methods of publicity.

It is a peculiar pleasure to find that Mr. Wordie had not too much of the Polar regions on his first expedition when he went with Sir Ernest Shackleton in the *Endurance* down into the Weddell Sea and experienced that year-long drift in the ice and that appalling vigil on Elephant Island, which together make one of the grimmest epics of Polar exploration. I think that Wordie then caught something of the spirit of Shackleton which enabled him to take the fullest advantage of every favourable opportunity and to emerge triumphant from the most difficult situations as they occurred. I do not think I have ever heard of any other small expedition turning to such good account every minute of favourable weather. It has solved several problems and pointed out several more that require fuller investigation. I would specially emphasize what the last speaker said about the peculiarities of weather on the Greenland coast. At this moment the conditions of climate on an ice-dome such as that which covers the interior of Greenland is attracting a great deal of attention, and Prof. Hobbs of Ann Arbor, who spent a large part of last summer in Greenland investigating those conditions, will carry out further work this year in the confident hope of throwing light on the general circulation of air over the Northern Atlantic and, incidentally, on the weather which makes our own country so fertile a topic of conversation.

I am not going into historical considerations nor into future prospects of such expeditions, but I should like to say, as a student of Polar exploration and

research, how greatly I am gratified by the efficiency with which this expedition was carried out and the happy way in which the results have been presented to us to-night by the leader and his staff.

The PRESIDENT: Would Mr. Wordie make any further observations?

Mr. J. M. WORDIE: I should like to thank you for the way in which you have listened to-night, and to add what I omitted to say in the course of the lecture: that is, an expression of appreciation of the way in which the party backed me up throughout the summer, working, in many cases, both day and night.

The PRESIDENT: We all join with Dr. Mill in congratulating this Cambridge party and its very able leader, Mr. Wordie, upon the success they have had: and we all hope that these Cambridge expeditions will be repeated; for it is quite clear that a party of comparatively young men, going to East Greenland full of enthusiasm, will still find much to study. I have little doubt they will end by getting up "Greenland's icy mountains" and, I trust, down again in safety.

I have only one thing to contribute. With regard to the Eskimo remains, there is nothing strange in finding only twelve graves to sixty-six huts, if you suppose that the occupation was not long and that the people were migrant, possibly because of the failure of ground game. Twelve deaths even in a total population of, say, about one hundred is a fairly high average in a few years. It seems to me that the difficulty felt about the small number of graves arises only if it be supposed the occupation lasted for a long time. Dr. Johnson did not give us any idea of the age of the burials, and I suppose it is practically impossible to say how long ago the occupation was. One must allow also for the probability that a hut was not necessarily used by the same family for long together; accidents may have happened to a hut in the course of the winter and another have had to be built; so that sixty-six huts might represent a great deal less than sixty-six families.

I was greatly interested in the articles found, particularly in the toggle with the horns on each side of it. Such toggles are found in different countries and in different climates. I suppose the explanation is that primitive man had everywhere the same necessities and worked out for himself the same kind of apparatus in order to deal with them. Altogether, the subject of these early Eskimo is extraordinarily interesting, as those who heard Rasmussen two years ago will have recognized. I think he said that it was failure of fish rather than of ground-game that accounted for the Eskimo moving on and completely deserting districts where they had been for generations.

The hour is late. I will not detain you longer, but ask you to give your cordial thanks to Mr. Wordie for a description given with extreme clearness, and for his admirable pictures. He made only the slightest reference to what must have been very considerable hardships that this expedition suffered. Possibly those hardships began the moment they left Aberdeen harbour in that little steamer of 64 tons—a hardship which some of us might have found more grievous than any met with on dry land in Greenland.

FORMOSA

E. H. de Bunsen, H.M. Consular Service, Japan

Read at the Meeting of the Society, 16 *May* 1927.

THE Island of Formosa has always been vested with a certain isolation and mystery. Though it lies at no great distance from the densely populated coast-line of Fokien, though its plains are fertile and not overcrowded, its natural resources considerable and its scenery magnificent, there have ever existed and exist to-day certain factors tending to maintain its seclusion.

In the past men avoided Formosa ; its shores were naturally dangerous and frequented by pirates ; malaria was prevalent, and the unstable, and not infrequently perilous, conditions of life in the island kept away all but the hardiest, not to say the most desperate of immigrants from the mainland. To-day Formosa is ruled by Japan and may well be considered the most prosperous part of her empire ; communications, both internal and maritime, have been developed and are always being improved ; its coasts are well lighted ; malaria has been checked ; in the Formosa Channel many great ocean routes converge. Remote from the world, however, Formosa still remains.

The reasons for this present isolation are above all economic. The majority of those who now visit the Far East do so, under normal conditions, for reasons of business. The economic life of Formosa is so closely connected with that of Japan that the bulk of its foreign trade is negotiated in Japan itself, with the result that few Europeans visit the island ; nor do the Japanese, essentially a home-keeping race, resort there in any great numbers ; nor, again, does Formosa offer at present any great facilities for the tourist, as opposed to the traveller.

In dealing with the Formosa of to-day, it may be well to give, in the briefest possible compass, a summary of such of its history as is known. To this summary I would preface a statement of my indebtedness to the valuable works of Mr. James W. Davidson, a Fellow of this Society, and of the Reverend William Campbell. The former came to Formosa during the Japanese campaigns of 1896 and 1897 as correspondent of the *New York Times*. He remained there subsequently for seven years as American Consul, and during that time he found time to produce his book ' Formosa Past and Present.' He now lives in Calgary. Mr. Campbell brought out in 1903 a relatively little-known but most scholarly work, ' Formosa under the Dutch.' As one deeply interested in Formosa and knowing the difficulties of ascertaining any facts about it, I would pay this tribute to the enormous amount of research which the production of these two books must have entailed.

Formosa was occupied, several centuries before the Christian Era, by an invading race known as the Longkius. During the second half

of the sixth century A.D. these were subjected, in their turn, by Malay invaders from the south. The descendants of these two races, and possibly those of others who had occupied the island before the Longkius, inhabit the mountains of Formosa to-day.

Early in the seventh century China sent an expedition to the island to demand its recognition of the Emperor and the payment of tribute to him. This the victorious Malays refused to do, and the Chinese retired after burning several coast villages. The Emperor thereon placed the island outside the pale of Chinese civilization, and for the next thousand years, until the fall of Koxinga's short-lived dynasty in 1682, it so remained. During these ten centuries Formosa was a No-Man's Land which became a pirate lair. Between the seventh and fifteenth centuries there is but scant mention of the island in Chinese annals, but there is evidence that sporadic intercourse, of a nature warlike rather than commercial, continued between it and the Empire.

It was during the fifteenth and sixteenth centuries that Formosa acquired, by reason of the differences then prevailing between China and Japan, a certain dubious eminence as a pirate headquarters. In 1443 the Ashikaga Dynasty in Japan came to an end, and through the years of turmoil which followed many landless and adventurous men, pirates at the same time as traders, took to the sea. So vexatious became their raids in Chinese waters that the Emperor of China was constrained to interdict his subjects from any intercourse with Japan, and to forbid, under penalty of death, the landing of any Japanese in his domains.

Formosa became accordingly an *entrepôt* through which an unauthorized but doubtless lucrative trade between the two estranged empires was handled; towards the end of the sixteenth century this trade was recognized by the Shogun, and a more definitely mercantile and less piratical class of Japanese was attracted to it. At the end of that century indeed two expeditions, officially recognized if not officially organized, were despatched from Japan to Formosa. Neither was successful. It was evident, however, that Japan was already watching with disquietude the activities of the Dutch, Spanish, and Portuguese in those waters.

During the seventeenth century the vicissitudes of Formosa were numerous.

The Portuguese had founded their colony of Macao in 1517. The Spaniards had occupied Manila in 1571, the Dutch Java in 1595. Between the three there existed bitter rivalry. Whether the Portuguese actually landed in Formosa is not known, but it was they who gave the island its name. "Ilha Formosa" they named it—the Island Beautiful; the scenery of her coasts may well have appealed to the eyes of men who had dwelt too long among the weary mudflats of the Canton River.

Thrice the Dutch endeavoured to oust the Portuguese from their settlement at Macao, and thrice they failed. After the last of these

attempts they sailed to the Pescadores, where they hastily constructed a fort, but later agreed with the Chinese to evacuate these islands (which were Chinese territory) and in return to accept the cession of Formosa (which was not), and in 1623 they landed at Amping.

The island might have remained permanently in the possession of the Dutch had not Koxinga, the last of the leaders of the Ming Loyalists in China, sought in Formosa a home for his lost cause.

This remarkable man was the son of Cheng Chi Lung, the foremost pirate trader of his day in Formosa and subsequently leader of the Ming forces on the mainland. Koxinga succeeded him in this command, and was for a time successful in his operations against the Tartars. Finally driven back on Amoy, he crossed to Formosa in 1661 and expelled the Dutch early in the following year. He died shortly afterwards and was succeeded by an undistinguished son who died in 1682; in the same year his nerveless grandson surrendered to the new order at Peking.

For the next two centuries Formosa was nominally part of the domains of the Emperor of China, but his authority was exercised in name rather than in fact. The island continued to attract adventurers, refugees, and exiles from the mainland. The natives could do little to withstand these hardy and acquisitive immigrants, who, by every artifice and stratagem, by fraud and by force, dispossessed them of the fertile plain lands. The weaker tribes remained on the lowlands and became partly merged with their conquerors, the stronger retreated to the mountains. Turbulence was the predominant feature of life in Formosa. The Chinese fought among themselves, rebelled incessantly against the Government at Peking, and were for ever at war with the natives. The latter conducted forays against the Chinese, while they hunted the heads of each other among their gloomy hills. "Every three years disorder, and every five years a rebellion," ran a Chinese saying of those days concerning Formosa. There was no law in the island.

It is advisable, in mentioning the turbulent conditions prevailing in Formosa during the seventeenth and eighteenth centuries, to bear several points in mind. China herself was on the whole, during that period, well and firmly governed; her rulers had no deep interest in Formosa, which had fallen into their possession by accident; the great majority of the Chinese emigrants thither were Hakkas, the landless men and "wandering Jews" of South China, homeless adventurers even in their own country.

Intercourse with European nations was but slight during the seventeenth and eighteenth centuries. Two Jesuit cartographers came in 1714; and in 1771 Benyowsky, who states that he was invited by the natives to establish a kingdom over them in opposition to the Chinese; and in 1778 La Pérouse, the French explorer. Formosa came under the notice of the Governments of Europe towards the middle of the nineteenth

century, when the increase of European commerce with the Far East brought to the China coast many men and many ships.

Of all the perils of the China seas, shipwreck on the coast of Formosa was perhaps that most to be feared. Stranded vessels were looted, and mariners who escaped from the island with their lives considered themselves fortunate. China disowned the actions of the Chinese in the island, and her authorities there declined to accept responsibility for outrages committed by the hill tribes, now embittered against all foreigners whomsoever. During the period from 1840 to 1895 there are recorded the losses of some eighty ships and two thousand lives on the coasts of Formosa. Numerous efforts, diplomatic, military, and naval, were made by foreign Powers to rectify this state of affairs—by the British in 1851, 1858, and 1865, by the Americans in 1854 and 1867, and by the Germans in 1860—but little permanent result was obtained until 1874, when the Japanese sent an expedition against the natives of the south. This expedition, whose commander dealt with his opponents in an exemplary spirit of gentle firmness, put an end to outrages on mariners in South Formosa.

For the next twenty years conditions in Formosa improved, though warfare between the natives and the Chinese continued. In 1884 the French, then at war with China, laid siege to Tansui and occupied Keelung. Their total force there numbered 3000 men, of whom 1000 were Foreign Legionaries. Of that unhappy occupation there is a grim survival to-day—the French cemetery at Keelung, where lie the bodies of 700 men, of whom no less than 430 died of disease.

In 1894 war broke out between China and Japan, and in 1895 China admitted defeat. A short-lived republic was established in Formosa by the local Chinese, who sought an escape from their difficulties by proposing to cede it to Great Britain. Lord Salisbury declined to accept this offer. In 1895 Japan occupied Formosa.

It took the Japanese six years or more to institute order in the plains, and they had not, even by 1925, completely established their rule in all parts of the mountain districts. I trust that I imply no slight on Japan in saying that her occupation of Formosa was primarily economic and strategic, and that she was interested in the Mountain Territory only in so far as she desired to develop the resources of the island without interference.

Her original policy in dealing with the Hill Tribes was military. In this she made but little headway, and that at a cost—both in life and money—quite disproportionate to the results obtained. Mistakes were made which did much to alienate those who might easily have become her friends.

The Chinese had maintained a special force on the frontier of the Hill Territory, chiefly in order to protect the camphor cutters working in that vicinity. The Japanese sought to reorganize and extend this

system and built, principally in the northern part of the island, defences to a total length of 359 miles. Of these some 120 miles consisted of wire fencing. This fencing proved of little practical use; the Savages crept through it, dug under it, or even jumped over it. Some portions of the line were electrified, but with little practical result; this method was expensive, and the Savages discovered that by driving dogs or other animals against the wires they could short-circuit the current and rob them of their mysterious potency. The Guard Line still remains; in many places, however, its present uses are for purposes of demarcation only or to keep hostile tribes apart.

More recently the authorities have adopted the use of aeroplanes in order to overawe recalcitrant communities and to impress the tribesmen generally. On one occasion only, in 1919, when this experiment was first tried, have bombs been dropped with the deliberate intention of taking life. Opinions as to the value of this method are widely divergent. Some police officers maintain that such demonstrations are most efficacious; others say that the Savages no longer pay any attention to aeroplanes. It would seem, however, that within a few years defences and aeroplanes will alike be unnecessary, for by 1925 there were only two districts in the whole island into which the Japanese or their agents had not penetrated. The present policy of the Japanese in dealing with these tribes is educational and conciliatory, and in describing two journeys which I made in the Savage districts in the south and north of the island at the end of 1925 and at the beginning of last year respectively, I hope to give some details of it. (The expressions "Savage" and "Savage territory," which are used in this paper in connection with the hill tribes are somewhat misleading. In many respects these tribes are not savage at all. The words in question are, however, the accepted translation of the Japanese designations *Seiban* and *Seibanchi* applied respectively to these tribes and this territory, and I have used them for the sake of convenience.)

The first of these journeys was made in December 1925. It took me to the territory of the Tsalisen group of the Paiwan tribe; until comparatively recent days this group had been notable head-hunters. Arrangements for this journey were made for me, at very short notice, by Mr. Kamada, the courteous and efficient Chief of the Savage Section of the Prefectural Police Bureau at Takao. He also arranged that I should be accompanied by two Japanese, Messrs. Morikawa and Nakano, the former a police officer and the latter a civilian.

Shortly before nine on the morning of December 10 we reached Hanario, a typical South Formosan village consisting of a cluster of Nipa houses overhung by palm trees. The road through it was occupied by all manner of live-stock—poultry, pigs, and water-buffaloes, and resembled a public farmyard rather than a public highway. Here we found the Savage porters who had come down from the hills to meet us. two

men Malayan in type, short of stature, and agile and wiry of frame. Their clothing consisted of a kind of short tunic reaching to the knee, and a loose "sarong" over one shoulder; suspended from the girdle of each was a long knife in an ornamented scabbard. Their hair they wore long and braided into a kind of headdress, and, like all Formosan Savages, they went barefoot. One of them was a village chief (Tomoku), a brave figure in his purple tunic ornamented with beads. He bade me good morning in Japanese, but in his demeanour and manner of his speech there was little to associate him with Japan, whose etiquette under such circumstances would call for reverences most profound. His utterance was sharp and clear, his bearing noble and proud; he stood upright and faced all men boldly with flashing eyes.

We first had to cross the vast river-beds of the Airyo river, which form a natural boundary between the Savage Territory and the cultivated lowlands. We had not yet reached the actual frontier, but one felt that civilization was left behind and that we were entering a strange and unknown land. Here and there we passed patches of cultivated land on plateaux among the stony wastes. The Chinese farmers hereabouts lead a precarious existence, ever threatened by flood, and must have led one more precarious still in the days, not so long past, when the Savages of the hills came down on their head-hunting forays, to take vicarious vengeance on the descendants of the race which, since the time of Koxinga and until the coming of the Japanese, had for ever been driving them from the lowlands.

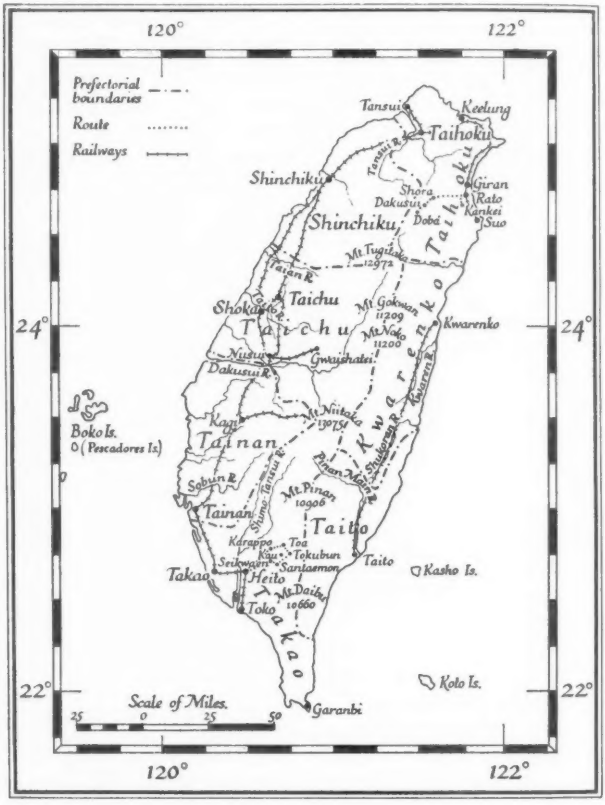
Though the going here was fairly good our progress was steady rather than rapid, for the Japanese maintain a set pace, which is a slow one; when put to it they can cover considerable distances in a day, but to do this they follow the military system of increasing the time, not the rate, of travelling. Our porters, however, went much faster and kept well ahead of us; they carried their loads slung on a pole after the manner of Chinese coolies, and, like them, walked with short quick steps and a slightly sideways gait.

At about half-past ten we reached Seikwaen, an isolated hamlet on the frontier of the Savage Territory. Beyond this point no Chinese or Japanese may enter the Savage Territories and no Savage go down to the plains without police permission. Here we were met by the Inspector in charge of the station at Santaemon, where we were to stop at noon.

From Seikwaen we continued our way towards the foot of the hills, which rose sharply out of the plain country; the going here was less stony, as we could follow a path above the level of the river-bed. The mountains were now closing in on us, and away to our right was a remarkable piece of natural engineering, a long slope, about 600 feet high at one end, which ran down for several miles to the plains behind us—its line so perfect that it was hard to believe that it was not artificial.

We now saw no more Chinese, but met several parties of Savages

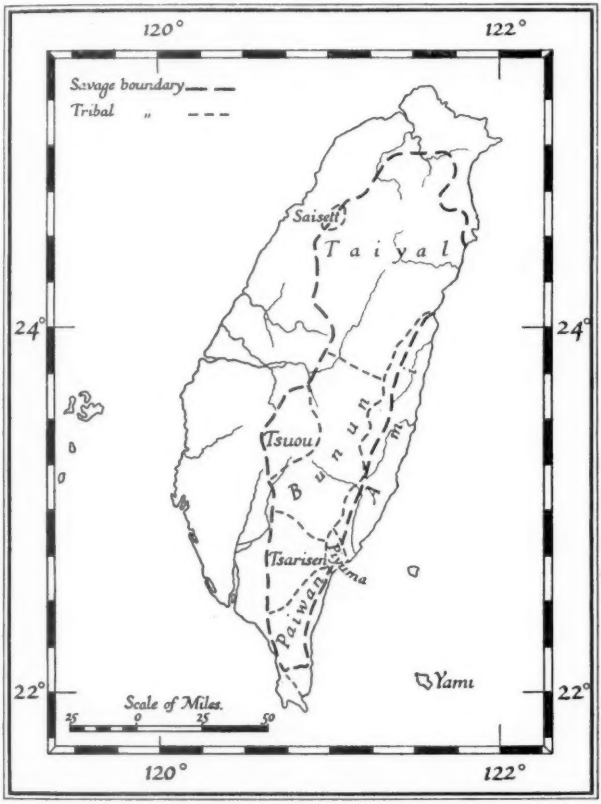
carrying loads down to the exchange at Seikwaen. They seemed on friendly terms with the police, and in their attitude towards them different from either the Japanese or the Formosan Chinese. The women went fully clad, and, owing to the heavy headdress which they adopt, looked at a distance very like European women of modest means, for not all the Savages wear the same gorgeous raiment as the chiefs. The usual



Sketch-map of Formosa

clothing of the Paiwan Savages is of that rather drab mixture of dark blue and red fabric which is familiar in the Igorot districts of the Philippines. On the way the officer from Santaemon told me how pleased they were at receiving a visitor. Such occasions were apparently rare; throughout the police spoke with great appreciation of the fact that Prince Chichibu had visited the Savage Territory and shown some interest in their work.

After about an hour's walking we came to a river which ran by the foot of the hills ; those of us who wore boots and not sandals were carried across on the chief's back, and then we started an easy climb into the hills. Another hour brought us to Santaemon, a Savage village where we were to stop for luncheon. The scholars of the local school were lining the path near the police station and joined on in rear of our small



Tribal Boundaries

procession. Both boys and girls wore a school uniform of European cut. To an English eye they might seem rather over-drilled, and the ferocious little Malayan faces of the small boys made an odd contrast to their modern clothing ; but for all that they seemed cheerful and contented.

At Santaemon I was informed that there had accrued to me the unusual honour of being the ghost of another man. Some sixty bean harvests ago, in the days which no man living remembered, there had

appeared among these same mountains a man who had come from a distant country across the sea, pale of face and tall of stature. He had been received in friendly wise by the head-hunting fathers of them that dwell in that land, and when he left he had promised that if he could he would come again. As he had never come himself, it was but natural to them that he should send his spirit to implement his promise.

That afternoon we passed a group of Savages engaged in widening the path under the superintendence of a police officer; unlike his colleagues of the plains, he had his coat off, and was taking an active part in the work. This was one of the good points about the mountain police; they are prepared to set to work and not merely watch others doing it.

In the more remote districts each village is made responsible for a certain amount of work on the paths each year, to be performed at times when agricultural operations are slack. Labour is thus contributed in lieu of taxes, which would indeed be difficult of collection in a part of the world where the use of currency is almost unknown. Whatever abuses may be inherent in a system of *corvée* imposed by a ruling race it would seem that no better one could be devised for these districts. The Savages have at all times maintained a strong communal life, and the idea of the maintenance of public utilities by the community comes naturally to them. The working party in question seemed to be cheerful enough, and greeted my escort in friendly wise.

Tokubun, which we reached about five, lies in a fine situation on the side of a deep valley, and is surrounded by tall trees. There is a large school here, and it is the principal police station of the district. Some distance from the village we were met by Mr. Yano, the headmaster of the school, accompanied by his pupils; in the absence of the Inspector, he did the honours of the place.

We put up at the Inspector's house, where we were entertained by Mr. Yano and the senior police officer at the station. The former struck me as being a man of unusual ability and character; he had formerly held a good scholastic position in Taihoku, but had come up to the Savage Territory because of his interest in the work there. He and his wife, who also taught in the school, had no children, and for that reason had felt free to come. His ideas regarding education in the Savage districts seemed eminently sensible: apt and intelligent pupils as he found the Savage children to be, he did not want them to occupy their minds entirely with their school-work, but to maintain their interest in agriculture and the practical side of life; it was not, he said, his aim to make scholars (*gakusha*) of them, but to put them in a way to help themselves. A broad-minded man and independent of regulations, he was considering the idea of teaching the children to read and write by means of the Latin and not the Japanese characters and cumbrous "Kana" syllabary, which is unsuitable for reproducing the various dialects

spoken by the Formosan aborigines, who have no written language of their own.

I gathered that the course lasts three years, and that the holidays are the same as those allowed in the ordinary elementary schools throughout Formosa; children who cannot reach their homes every night go every week-end—even those attending schools like that at Kappanzan, where most of them come from remote villages across the guard line—and their parents are encouraged to come and see them.

If the fathers are unwilling to let their children go to school they are liable to have their hunting licences suspended; but as a rule little compulsion is necessary. In the case of children from the unopened districts it is impossible, for in dealing with these the Japanese authorities have to depend on police agents, chosen from among the Savages themselves, who can only enter such districts by the goodwill of their inhabitants.

School-life seemed to be popular. The village generally was by way of being on holiday in view of the arrival of a visitor, and the elders of Tokubun and the children under school age gathered round the doors and windows to watch the proceedings within. A group of the latter indeed, cheerful, unmolested, and unclothed, formed a voluntary kindergarten class in a corner of the playground.

At ten next day we bade farewell to Mr. Yano and continued our way northward. The first part of the way led uphill and afforded a commanding view of the surrounding country, for we were now some 3000 feet above sea-level. To the east lay the range of mountains which runs from north to south of Formosa and forms the backbone of the island. We were at present on one of the western spurs of this range, the peaks to the east being about 8000 feet and the hills round us about half that height; the latter were covered for the most part with low scrub and rounded in contour rather than precipitous, except where they descended sharply into the valleys, which were narrow and taken up entirely by river-beds. Although no rain had fallen for some time there was plenty of water in the streams, and it required little imagination to realize how quickly they could turn into raging torrents which would in their turn flood the shallow rivers of the plains.

Shortly after leaving Tokubun we passed through a small native village, and I had the opportunity of examining the houses used by the Paiwan savages. These are of two kinds: the one Malayan in appearance, with a heavy thatched roof and raised on poles above the ground; the walls and the floor formed of wooden poles, interstices in the former being filled with mud. The second type of house was less familiar, being built throughout of heavy slates, with a platform also of slates in front. The outside of the better class of these slate houses is decorated with a frieze of human faces carved in a stereotyped design.

I entered one of these houses. The doorway is low, and so constructed that it can be entered only by crawling on one's hands and knees. In

days past men built thus as a measure of protection, for it places the man inside at an advantage over the enemy who is trying to enter. This house contained only one room, with a fireplace at one end and a raised platform at the other, whereon the whole family sleep together. There was no mural decoration except one figure of a man's head, roughly carved in wood. Perhaps this took the place of the grimmer ornaments of former days, when the trophies of the chase adorned the walls and were left there to moulder.

For about an hour and a half we climbed steadily upwards, following an excellent and well-graded path high up along the side of a deep valley. At the top of the pass we were met by a fresh relay of bearers and a police sergeant from Toa, where we were to halt at noon. A short halt to rest after our climb was followed by a sharp descent with one or two rough scrambles to this village, which lies at the bottom of a valley.

Toa was the most remote spot which I reached. It lies at a short distance from one of the few remaining unopened districts, and forms a junction for the three tracks: that from the south, by which we had come; that to the west, which we were now to follow; and a third leading eastwards over the mountains to Taito Prefecture and the open Pacific beyond. I wished that I could have gone farther east into the mountains, but time was limited, and we were due back in Takao on the following evening.

From Toa to Coa, the last place at which we were to stop in the Savage Territory, was a three hours' journey up and down hill—out of one valley, over a pass, down a second valley, and up its farther side. The scenery was wilder than that of the country through which we had hitherto passed, the hillsides being more precipitous and covered with fir trees and dense undergrowth. Possibly for this reason this district had until recently been a notoriously dangerous one, and only ten years before Savages had murdered thirteen police officers engaged in making the path which we were now following.

We had crossed the pass and were going down a path heavily overhung with trees when suddenly there appeared from amid the undergrowth a Savage chief of martial bearing; his tunic was of scarlet, his helmet of polished leather and surmounted by a white plume; at his side hung a sword in a richly decorated scabbard. This was Rumariu, the famous rebel of former days who had long defied the Japanese among those mountains, and had led the party which had ambushed them thirteen years before; for a time his liberty had been curtailed, but he now went his way as a free man.

Shortly before five we reached the small village of Coa. We found the staff of the police station somewhat depleted; the inspector in charge of the post was absent on sick leave, and a junior left in charge. Not only had the latter to attend single-handed to his official duties, but to his wife and her three-weeks-old baby as well. Our visit seemed scarcely

Police officers and Savages at Tokubun

Malayan type of house, Paiwan district

Paiwan Savage outside slave house, Coa

Bride and bridegroom, Paiwan Savages, Coa

Tayal hunters

opportune, and for a moment I was ungenerous enough to think that I was not going to get very much of interest out of Coa. In this I was wrong; not only did the policeman make us very comfortable, but I learnt more about the district from him than from any one else.

I record here, supplemented by data collected elsewhere during this journey, what I was told at Coa regarding the police system in the Savage Districts and the customs of the Tsalisen group of the Paiwan Tribe.

Though it is difficult enough to get Japanese to go to Formosa at all, police service in the Savage Districts attracts an adequate supply of recruits, as it offers certain advantages. Many necessities of life are obtained in the mountains more cheaply than in the plains, and the life does not offer many opportunities for spending money; men are more on their own, have large districts to look after, and receive a certain extra allowance. Unsuitable men are weeded out, for whatever advantages service in the "*Seibanchi*" may offer, they afford no scope for men whose hearts are not in their work.

A list of the various duties undertaken by the Police in the Savage Territory is a remarkable one: they include the several functions of Schoolmasters, Postmasters, Judges, Civil Engineers, Physicians, Surgeons, Carpenters, Telephone Linesmen, Bridge Builders, Assessors, Commission Agents (without the commission), Fortune Tellers, Glaziers, Astronomers, Strolling Players, Arbitrators, Blacksmiths, and Agriculturalists. They have to administer the Emperor's Government and to wield his authority; to construct waterworks, to instruct in and supervise sanitation; to act as foresters, gymnastic instructors and vets.; in fact, to do at the shortest of notice anything that is required of them by the primitive peoples among whom they dwell.

In the handling of the question of firearms and knives the authorities show great common sense. The Savages are allowed to take firearms with them on hunting expeditions not exceeding four days at a time, and are permitted to carry their knives freely so long as they register them with the police at the time of manufacture or purchase. The history of the stocks of rifles owned by the Savages before the coming of the Japanese is vested with an element of comedy, for the former obtained them from the soldiery of China who were ready to trade them for camphor. There is believed to be still a certain amount of illicit trafficking in firearms between the Savages and the Chinese on the east coast of the island.

Minor offences, which occur but seldom, can be met by a suspension of permission to use firearms; this seems to be in most cases a sufficient form of punishment or deterrent in minor matters, for while not cutting a Savage off entirely from his means of livelihood, it keeps him from hunting, his favourite occupation, and his chance of obtaining meat and deerskins.

The punishment of major offences is a more difficult matter. Imprisonment at the nearest Japanese gaol is the normal punishment for

murder, but it does not answer well. If of low vitality, a Savage in a Japanese prison may get over the depressing lack of freedom and in fact find himself more comfortable there than at home.

On the other hand, many savages die merely from confinement, or else develop beri beri, and in view of their recent policy of conciliation the Japanese do not desire to get a bad name again among the Savages through the ill results brought about by putting them in prison. Theft is rare among the Savages. I gathered that in practice the police have to get along as best they can in dealing with such crime as exists. It is one thing to make laws and another to apply their letter to the government of an alien people who have scarcely begun to comprehend their spirit.

Marriage among the Tsalisen Paiwans is a matter of individual choice, and not of family arrangement. The proposal can come from either party, but it is more usually the man who makes it. The manner of wooing is peculiar: after taking steps to acquaint the lady, through a third party, of what his intentions are, the suitor takes a bundle of firewood by night and leaves it outside the door of the house where she lives. If the bundle is taken inside the house, it is a sign that he may continue his suit; if left *in situ* it is an indication that his advances are rejected. By way of continuing his attentions the man continues to bring firewood, never entering the house, but always leaving it beside the door. If the lady should change her mind it is etiquette for her to decline to accept further supplies. If however all goes well, she will one evening invite the suitor to enter, and such an invitation is held to constitute a binding engagement.

Their standard of morality as between the sexes is exceedingly high, probably as high as any in the world. In some districts the younger unmarried men "live out" in the village bachelors' quarters where the skulls of slain enemies are kept; but in many cases the entire family, three or even four generations (about twelve persons in all), live in a one-roomed house together. Whereas mothers-in-law in Japan are proverbial for their harshness, among the Savages they treat their daughters-in-law kindly. Bachelors and old maids are rare, but it is no special disgrace to a woman to remain unmarried. There are various social grades among the members of each village group, and it is difficult for a man from a family of low social status to obtain the daughter of a chief in marriage unless he is a man of wealth, the possessor of many necklaces or pigs, while a man coming of a chief's family can choose a bride where he will. Marriage among blood-relations is uncommon. Men usually marry when about twenty-eight years of age, girls from fourteen and upwards. They are not a long-lived race as a rule, and a man of sixty-five is considered to have attained patriarchal age.

No ceremonies are held in connection with birth, and women attend to themselves during confinement. Infantile mortality is high, possibly

as a consequence of this. The population is at present stationary as regards numbers; if anything, it had been of late years slightly on the decline: this may be due to their gradual transition from an entirely primitive and barbarous state to one slightly less unsophisticated. The elements of modern sanitation and medical practice introduced by the Japanese may make for an increase as long as the Savages are left free from the competition of modern civilization.

Weddings are an occasion of great feasting for the entire community, and I might have witnessed one if I had been there a few days earlier, for the daughter of the village chief of Coa had just been married to the heir of the chief of a neighbouring village. It may be noted that intermarriage between members of different tribes is rare.

The burial customs of the Tsalisen Paiwans are more remarkable than sanitary. The dead are buried, generally within twenty-four hours of death, or even on the same day, underneath the floor of the family house. When a house is new, provision for the future demands that the first bodies to be buried there should be interred as deep down as possible, for custom ordains that when there is no more room for graves under the floor the house must be abandoned.

Scarce as is published information concerning the Formosan Savages, references to their head-hunting customs are available in several books. The practice is believed to have been on the wane even before the coming of the Japanese. In this particular district occasional cases of it still occur, the perpetrator being usually some young man who wishes to gain local prestige among his fellow-tribesmen and to maintain what he deems to be a laudable tradition.

One particularly barbarous custom among the Tsalisen Paiwans consisted in the returning warrior filling a freshly cut head with native spirit and passing it round the circle of his fellow-villagers as a loving cup. (N.B.—I may have misinterpreted the words used by my informant here; he may have meant that the brains were scooped out from the head and then drunk mixed with native spirit.) In some cases the heads of the slain enemies were placed on a shelf inside the house with the family collection of similar trophies and left with them until such time as the processes of nature reduced it to a skull. In other cases they were buried either in the ground or in a tumulus above it; in others, again, the skulls were placed in the communal skull heap, or placed in the village bachelor quarters.

Many of these heaps can still be seen, and it is believed that the majority of the skulls in them are those of Chinese, who were in former days the hereditary enemies of all the Savages irrespective of tribe. Feuds among the Savages themselves were moreover incessant. The claims of the community were paramount, and if a man through marriage or migration became a member of village or clan other than that to which he had originally belonged, he owed allegiance to the latter only. Father

killed son, the son his father; brother killed brother. The communal tie overbore that of family.

Peace between warring communities was made either by the belligerents direct or through the mediation of a neutral community. Nowadays the different clans which compose the six main tribes of Formosa live at peace with each other, but there is still considerable enmity between the various tribes, and a member of one tribe entering the territory of another only does so under police protection and with a "passport" issued to him by the police of his own village.

The Savages put a very high value on their necklaces, and the beads of which these are made enter into their primitive calculations of currency. Among them one bead passes for the value of twenty small pigs, or some two pounds sterling, one small pig being the rough equivalent of one Japanese yen. For the reckoning of small amounts firewood passes for value. Though they are gradually learning the use of money properly so called, the Savages prize silver and nickel coins more for ornament than for use. Forty sen is considered liberal payment to a porter for a full day's work. Reckonings involving the higher bead or pig denominations probably come into use relatively seldom, and then only for such major transactions as the building of a new house. Possessing no system of writing, their only contracts are verbal. As with other primitive peoples, these are strictly observed.

In agriculture the Savages exhibit all that happy improvidence which is one of their most noticeable characteristics. Their principal crops are sweet potatoes and beans. The former are obtained by transplanting seedlings which grow to maturity in one year. After each crop the ground is left to lie fallow for three or four years. Beans are cropped from the same lot once every three years, the ground being left fallow for two years out of the three. The use of fertilizers has been tried, but without avail, as they are washed away down the steep hillsides. Their method of fertilization is to let the undergrowth come up on the fallow ground and to burn it off before planting.

At half-past nine we left Coa, and an easy hour's walk downhill brought us to Coashakei, on the edge of the river-bed of the Tansuigawa; hence after an hour's walk amid stones and occasional patches of cultivated land we reached Karappo, on the Savage boundary, where rickshas from Heito were waiting for us. As we had a certain amount of time in hand we spent an hour here, and I went with Morikawa to see the Barter Station. Here we found a group of Savages who were bargaining with a Chinaman for the exchange of deer-skins, Tsuso fibre, and other products of the hills. The system seemed to be well conducted; the police set a fixed scale of prices for the articles required by the Savages, and superintend those of the commodities—cloth, beads, and the like—which the latter wish to take in exchange. These barter stations are conducted by the police or by picked Chinese. In this particular one I

saw several skins hanging out to dry, but not much else, save a few strings of cheap beads and some medicines, among which I noted one English importation—a bottle of British quinine; malaria, which the Japanese have done so much to exterminate in the plains, has recently become prevalent among the Savages in that part of the country.

This system is a good one. It was not only by physical force that the Chinese first dispossessed the Formosan aborigines of their land and drove them into the hills. A few beads or flashy ornaments sufficed to purchase their lands or to induce them to mortgage them to the invaders, and the Savages would even now, if unprotected, be an easy prey to unscrupulous and astute traders peddling the meretricious wares of Osaka and Nagoya.

My second journey, which took me to the outskirts of the Tayal country on the north-east coast, was made in the few days available between the date of the end of my appointment at Tansui and my departure from Formosa. I am indebted to Mr. Nakata, the Chief of the Savage Territory Police in the Formosan Government-General, for the very prompt and courteous manner in which he arranged this journey for me.

I was accompanied on it by a police officer, Shingo by name. I could not ask for a better guide or more loyal retainer. Shingo had served in the Japanese Navy, and his ship had been one of those which had been despatched to England at the time of the Coronation in 1911. Never, to judge from his account of his visit to this country, had men enjoyed themselves so thoroughly as did the crews of those Japanese warships. He could not say enough of the excellence of England, the stately magnificence of her pageantry, and the disinterested friendship of her people.

Owing to limitations of time, I was unable during this journey to get very far from the frontier line or from the timber districts along the Dakusui (Dragon Water) River. These districts are accessible without permit to both Japanese and Chinese; consequently I saw but little of the Tayals in their original surroundings.

Early on the morning of February 12 we left the little town of Rato, which we had reached the previous night, and at noon came to Kankei, a Savage village on the frontier. Although the construction of the dwellings at Kankei and the domestic habits of the Tayals seemed little changed, one noted many signs of Japanese influence. For one thing their clothing, especially that of the children, was wholly or partly of Japanese make and style. There were a number of Japanese there, lumbermen and clog-makers, who were instructing the Savages in the making of *Geta* (Japanese wooden clogs).

Leaving Kankei we once again entered the "open" territory. The villages through which we passed were *en fête* for the Chinese New Year, and the holiday spirit abroad in the land was but enhanced by the free entertainment afforded by the tall barbarian and his escort.

At about half-past three we reached a large village, Sanshei, where we rested for a few minutes at the police station. We then set out for Tensonpi, where we should re-enter the Savage Territory. Our way led up a gradually narrowing valley, fertile to all appearances and planted with the usual plots of rice and sugar. On the hillsides on either hand Savage settlements were visible, each overhung with a cloud of smoke hovering over palm trees.

Tensonpi was reached soon after four. Here we were met by Mr. Muto, the senior Police Officer of the neighbourhood and the Chief of the Station at Shora, where we were to stop that night. Two subordinates came with them—the one an armed gendarme, whose rifle and trim uniform lent a touch of frontier romance to our little party, the other a cheerful young Tayal who might be described, without any of the evil implication attaching to that expression, as a "copper's nark." In his earlier days he had been selected as a promising candidate for the Buddhist priesthood, and had been sent to a Buddhist school at Taihoku, but a perpetual diet of fish and vegetables and the monotonous gloom of temple life had not appealed to the naturally carnivorous appetite and happy-go-lucky spirit of this sturdy young mountaineer. In ignorance of his name I mentally christened him the Apostate.

From Tensonpi a roughly laid push-car track led across the valley and along its farther bank to Shora. The Apostate took charge of the transport arrangements, and for an hour we bumped and jarred along the rails. It could hardly be expected that the track should be adapted to smooth or swift travelling. Every year in flood-time it is liable to be swept away, and it would be scarcely worth while to attempt to lay it with any great precision.

At about five we reached Shora, where followed a formal welcome at the Police Station. We then went down to the village; the houses were of the modernized barrack type which the Japanese are introducing into the district—two-roomed dwellings with a kitchen and without the customary sunk floor. Current from a neighbouring saw-mill moreover provided electric lighting, a source of joy and wonder to the inhabitants.

We left Shora in single file across a strip of marshy country which led down to the river-bed. First went the armed gendarme, his rifle at the trail, then Inspector Muto and then I, while the sergeant from Shora and Shingo brought up the rear. The weather was cloudy and gloomy mountains rose in front of us. During this journey, however, we were never out of touch with the island's more modern aspect. There are lumber and camphor workings on the lower slopes of the mountains, and a light railway ran through the country on the other side of the river.

A short walk brought us back to the north bank of the Dakusui. We then made our way upstream along a narrow track among the boulders of the river-bed, and an hour later reached a narrow gorge spanned by one of the wire suspension bridges which the authorities

have standardized in those districts. These bridges have plenty of "give" in them, and their swaying motion renders progress across them an undignified proceeding. Our road now lay above and along the side of the river for some 100 yards. First it passed through a tunnel in the face of a cliff—a piece of work typical of Japanese determination to keep communications open—and after it through a dense forest. The sun came out and the temperature became tropical again. Beautiful and grim were the forest-covered mountains, which had only recently seen so much savagery, for this district also had until recently been a bad one. At one point we passed a deserted police post, abandoned and ruinous, which stood at the point where our road made a sharp entry and exit into and from a narrow valley to our right. This spot had formerly been the scene of much bloodshed. The police on guard there can rarely have seen their enemies. It was courting death to be seen by them, and almost certain death to follow them.

Our halting-place at noon was the little post of Bonbon, a cheerful name in that once grim locality.

Early in the afternoon we set out for the post of Dakusui, on the opposite bank of the river to which it gives its name. The river-bed was for the most part dry, but we had to cross several small streams by singularly unpleasant little bridges built ladder fashion and shaped like croquet hoops. The one-side rail was of the flimsiest variety, and the streams beneath ran deep and swift over rocky beds. Dakusui is an important station and general headquarters for the surrounding posts.

The day of our visit coincided with that of Mr. Takahashi, the Chief of Police of the Rato district. He had come up to attend the usual monthly meeting of all officers who can be spared from duty in the locality, and the station had the busy aspect. One group of police officers was attending a lecture on sanitation, another was engaged in the strenuous sport of *Gekken*, a form of single-stick.

On leaving Dakusui we saw some interesting work in progress: the police, assisted by Chinese labourers, were laying out rice paddies in the marshy land by the river, with the double purpose of providing the Savages with an improved diet and of checking the malaria mosquito, the curse of life in the valley. The police were doing coolie work and seeming to enjoy it, while the Savages, for whose benefit it was being done, were absent. On inquiring for the reason of this, I was told that they work when they feel inclined, and that during the hunting season it was useless to try and keep them at it; the male population of the village were now out hunting to a man. A short time after leaving Dakusui on the last stage of our day's journey, we met the villagers returning from the chase. They formed a picturesque group with their oddly peaked jockey caps. Like most of the Savages I saw, they seemed to be on good terms with my escort; their attitude towards them was one of lackadaisical and independent cheerfulness.

It was growing dark when we turned left up the valley of one of the tributaries of the Dakusui and saw Doba in front of us. The view away to the right was a magnificent one. Lowering clouds overhung the lofty mountains, and I cast a regretful eye on the valley which led into them towards the distant watershed of the Dakusui.

We were escorted to the Forestry Bureau club house, a well-built structure in Japanese style, where the forest superintendents and other officials resort to relieve the monotony of their exile, and enjoy the natural hot baths ever dear to the Japanese.

After supper I joined a party of Japanese officials staying at the inn and heard something of their work in the great cypress forests of the surrounding mountains. Their life is lonely enough, but the pay is high—80 yen a month and upwards for the lowest-paid Japanese, and a bonus of 30 yen for each recruit obtained from the mainland.

We were to have taken the train at nine the next day, but it was delayed by landslides, and we did not leave till nearly noon. At last Shingo and I boarded the train in company with a mixed assembly of Chinese coolies, Japanese foremen, and sundry travellers discharged from the depths of the mountains. We were given the place of honour on small chairs placed under the projecting ends of baulks of timber, which afforded partial shelter from the weather. As we bumped and rolled down the valley I had an interesting conversation with one of the foremen, a Japanese from Kyushu. He seemed to know an extraordinary amount concerning Europe and America. H. G. Wells' ' History of the World ' was the main source of his knowledge, and many historical personages had become to him, from the cinema, living beings. It was strange to hear him speak of Robin Hood, Friar Tuck, and Little John.

In the middle of the afternoon we reached Rato, where the officials of the Forestry Bureau made us welcome and showed us over their establishment. The following day I left Formosa.

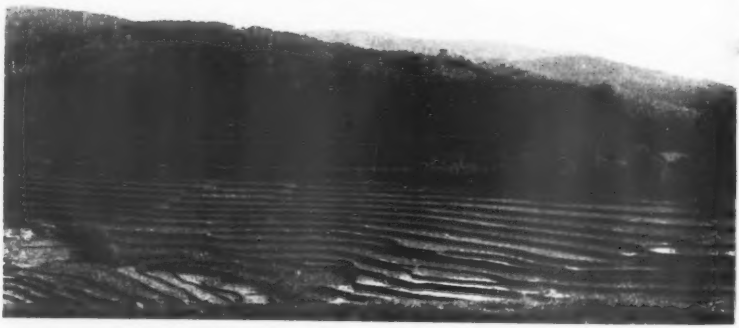
I think that I am justified in saying that the Japanese Police of the Savage Territory in Formosa have adopted an admirable policy and that this policy is meeting with success. I do not desire to convey the idea that all is perfect there. Contact with the outside world brings to the Savages, as to other primitive peoples, little that is good. In the frontier districts, where persons other than the police resort for purposes of pleasure or gain, their lot is not always a happy one. Frontiers, however, and the commercial fringes of Empire are seamy places, and by them can no administration be judged. In order to reach any balanced conclusion regarding the Savage Territory of Formosa these things must be mentioned, but my memories are not of these things. They are memories of days, all too few, spent in the company of men whose lives are lonely, whose material rewards are few, whose employment is frequently arduous, whose work is little known, and whose duty is well done.

Paiwan Savages, Santaemon

A woman of the Paiwan tribe, Coashakei

UNIV. OF MICH.

British Consulate, Tansui



Terraced rice-fields near Tansui

Dakusui valley

Before the paper the PRESIDENT (Dr. HOGARTH) said: Our business to-night is with the Island of Formosa, that island to which the Portuguese, perhaps rather indiscriminately, gave a beautiful name. I gather that there is everything to justify that name, except possibly the human inhabitants. Well, most of us own to abysmal ignorance about the Island of Formosa, and it is certainly a very long time—approaching the lapse of a generation—since any account of it has been given to this Society. It is still, I gather, by no means perfectly known, and although it may not be possible to tell the same lies about it that the so-called Psalmanazar told in the eighteenth century, at the same time there is room for a good deal of invention! However, Mr. de Bunsen, of the British Consular Service, who is going to speak to you to-night, will simply tell you about that part of the island which he saw. He made two journeys in the island, and he will restrict himself to them. Therefore you must not expect from his paper a complete account of Formosa, or an account even of its most remarkable features; but just an account of what he saw and did in certain parts of the island and, in particular, of the political conditions that now obtain under the rule of its Japanese masters. He will have a series of views to show which I think will be new to you, and altogether, seeing how little we know of the island, we are fortunate in being able to get a first-hand account of even a part of it. I will ask Mr. de Bunsen to read his paper.

Mr. de Bunsen then read the paper printed above, and a discussion followed.

The PRESIDENT: We welcome here to-night the Military Attaché of the Japanese Embassy. Would he like to say a few words? . . . If he would rather not, I will call upon Major Owen Rutter, who is acquainted with this part of the world, and has written a book on Formosa.

Major OWEN RUTTER: It is true that I must confess to having written a book on Formosa, but I should like to say at once that it was written from the point of view only of the passer-by, because whatever my faults, one I do disclaim: that of going to a country for a few weeks and then writing a book entitled 'Formosa From Within.' My visit to Formosa came about a few years ago more by accident than by design. I was on my way back with my wife from North Borneo and was offered a letter of introduction to the Governor-General of Formosa. As I make it a principle in life never to refuse a good offer, I accepted the invitation, and when we arrived our welcome exceeded our wildest dreams. There are no people in the world, I think, more hospitable to passing travellers, when they know they have a recommendation, than are the Japanese, although they do not encourage the ordinary tourist to go to Formosa. That is why the island is of real interest and off the beaten track. When we arrived at Takao we were met by a Japanese gentleman who announced that he was to be our A.D.C. while we were in Formosa. Everywhere we went there was a train ready or a motor car, and when we got out of the car there were rooms in a hotel and probably dinner awaiting us. They not only showed us, after the manner of governments, everything that they wanted us to see, but they also allowed us to see all, or very nearly all, that we wanted to see ourselves.

Now Mr. de Bunsen has shown you a wonderful picture of the hill country. Perhaps I can just fill in very briefly the other side of it. Formosa is divided almost by a straight line into two parts, the eastern and the western. The eastern part consists of enormous hills dropping down into cliffs that fall 6000 feet sheer down to the sea, and on the western side low undulating hills slope down to the coastal plains, intensely cultivated with rice, tea, and sugar.

It was amazing to me, having come from the country of North Borneo, which has been in the hands of the British for nearly fifty years, to see what the Japanese had done in Formosa in just over twenty-five. It was really positively amazing. There were roads everywhere. A railway ran from north to south. In Taihoku, the capital, there were finer streets, I think Mr. de Bunsen will agree, than in the big towns of the Japanese Empire. Money has been poured into Formosa by the Japanese; to them it is like a ewe lamb. They have been intent on developing it, and they have succeeded. There are fine buildings, and the island has wonderful resources. Nearly all the camphor in the world comes from Formosa; that is a link for you when you go and buy a cube of it in the chemist's shop.

I was very anxious to get up into the hills to see the Savage country, and I was allowed to do that, but not allowed to go very far in, because it was suggested, in a jocular way, that I might leave my head behind; but I was able to see something of the Savages, and I felt that I was really among friends when I saw those people, because they were so curiously close to the people I had known and, before the War, been used to administering in the Borneo hills. Mr. de Bunsen spoke very highly of them. I was glad he did, because although I did not see very much of them they struck me as being a fine, upstanding, never-cringing, friendly, likeable people. They are called Savages, and when you come to think of it there is no real reason why they should not have been savage. I think if we had been treated as they were in the early days of the Chinese adventurers, we should probably have been very savage too. But there were good administrators even in those days, and if I may, I will just tell you the story of Goho, a very famous Chinese administrator of the Savage races, who tried to wean them from head-hunting. For several years he had managed to persuade them to substitute the heads of oxen and buffalo for human heads. But when the harvest was going badly they came to Goho and said, "We must have a head for the next harvest." He saw they really meant business, and replied: "Go into a certain clearing to-morrow morning and you will see a figure covered in a red cloth. His head you may take for your sacrifice." They went and saw a figure and cut the head off without realizing whose it was. When the red cloth fell from the head they found it was Goho. It is said, and I believe it is a matter of official history, that these people were so horrified that they took an oath to stop head-hunting and human sacrifice, and they have kept that oath to this day. A high official of the Japanese government placed on Goho's tomb an inscription which, being rendered into English, means: "A candle by consuming itself gives light to others."

Mr. de Bunsen has shown us that the Japanese are succeeding in their administration of these primitive people, and those who have been doing similar work in other parts of the British Empire, as many here have, know what that task is and how difficult. It needs great patience, tact, forbearance, and forethought, combined with justice and, on occasions, firmness. We have seen that the Japanese are showing those qualities, and we may join in the hope that they will go on and succeed until the whole of that Savage area is savage no more and is at peace.

The PRESIDENT: I am afraid, as I have said before in this room, that the penalty of having an account of a very remote and little-known country is that we have practically no one else to call upon in the hall who claims any knowledge of Formosa. Would Mr. de Bunsen like to say anything in reply to what Major Rutter has said?

Mr. E. H. de BUNSEN: I would say only I am exceedingly glad to find that Major Rutter is in agreement with my views. He spent only ten days in Formosa, but his book, I think, may be taken as a very sound description of life in the island to-day. With all due respect, I draw attention to one little point in it. Major Rutter states that it is sad to see children taken from their homes for so many years and kept at school. I made particular inquiries on that point, and, as I was careful to stress in my lecture, I found out that they are given long holidays. Really the whole idea of these schools is not so much to educate the children as to get them to grow up liking and knowing the Japanese.

The PRESIDENT: I am glad Mr. de Bunsen said another word about the schools, because nothing intrigued me so much as the photograph showing school-children. Am I right in assuming that those children were dressed very much in the same sort of garb as we should see upon English school-children?

Mr. de BUNSEN: The President is correct. The children are dressed in light cotton garments because the great difficulty is to keep their clothes clean. The Savages wash their bodies very often, but, from such contact as I had with them, their clothing not at all. Light cotton clothing seems to be the only thing to meet that difficulty.

The PRESIDENT: That accounts for the remarkably familiar appearance of that group of little girls! Now, ladies and gentlemen, between Mr. de Bunsen and Major Rutter we have heard a good deal about Formosa, and, speaking for myself at any rate, I have heard enough to make me want to know more. I hope that some day somebody will come and tell us about that Eastern mountain country, and particularly about its face or fall of 5000 or 6000 feet practically sheer into the sea. If some one will kindly cruise round that eastern coast and bring back a series of photographs I will undertake to say the Royal Geographical Society will be most glad to see them. Mr. de Bunsen made no secret of the fact that a very large unexplored tract lay between the two points at which he went some distance inland into the island, but he has given us an idea of what to expect, more or less, of the large tract which he did not actually visit. As I have already said, it has been a very long time since this Society has heard anything about Formosa. We are grateful to Mr. de Bunsen for recalling it to our notice, and I hope you will signify your thanks.

THE "VALLEY RIVER" OF LABRADOR

IN May last we received from Mr. James White, Technical Adviser to the Department of Justice, Ottawa, the following comments on Mr. Frissell's paper in the April *Journal*:

In "Explorations in the Grand Falls Region of Labrador," in the April number of the *Journal*, Mr. Varick Frissell records his discovery that the stream discharging the eastern bay of Ossokmanuan lake falls into the Hamilton river between Bowdoin cañon and Big Hill portage, and not—as Low supposed—at the mouth of the cañon.

I am sending herewith a tracing of Low's plotting sheet which shows that Valley river falls into the Hamilton 8 miles above the portage and 5 miles below the cañon.

When compiling the map, the draughtsman overlooked this stream and,

being deceived by the width of the upper tributary where it falls into the Hamilton, assumed that it was the mouth of Valley river.

Inasmuch as Low applied the name "Valley" to the river which carries the discharge of the eastern outlet of Ossokmanuan lake, the river which falls in above Big Hill portage is Valley river, and not Grenfell river, as indicated by Mr. Frissell.

Mr. Frissell "accepts the contradictory evidence given on his [Low's] map, viz. that the current on the Attikonak runs south from Sandgirt to Ossokmanuan." This is virtually a statement that, when Low surveyed the Attikonak river from Sandgirt southward, he did not know whether he was ascending or descending the rapids in the short stretch of river below Ossokmanuan.

Examination of his plotting sheets shows that the figure "1600" given for Ossokmanuan lake is a draughtsman's error for "1660." There is, therefore, a *fall* of 10 feet from Ossokmanuan to Sandgirt, and not a *rise* of 50 feet as indicated on Low's map.

The accompanying tracing showed the mouth of a river (unnamed) which is evidently the "large branch" mentioned by Low under "Unknown Channels" (*Report*, p. 139), and which Mr. Frissell calls the Grenfell River. But the question remained, to what river did Low apply the name "Valley"? We had already in the footnote on p. 339 inferred the mistake in the spot height, and disagreed with Mr. Frissell's remark on the direction of the flow between the lakes.

In subsequent correspondence Mr. White supplements his first note as follows:

(1) The name "Valley River" appears once and once only on Low's plotting sheets, namely, on the sheet that shows Ossokmanuan lake.

It is evident, therefore, that he was deceived by the width of the stream that falls into the Hamilton at its debouchment from the Bowdoin Cañon and assumed that it must also carry part of the discharge of Ossokmanuan lake.

We now know that the river named "Valley river" by Low enters through a canon similar to Bowdoin canon, but the notebook showed such a small portion of what Frissell calls "Grenfell" river, that it was overlooked when replotted for the map.

When the work was draughted on the map, probably Low forgot about the lower stream and assumed that the Valley River discharge of Ossokmanuan lake probably debouched into the Hamilton where the wide tributary joined it at the lower end of the cañon. At the same time, he carefully indicated it by broken lines to show that its course was not known.

Again, draughting the name "Valley River" so close to the outlet of Ossokmanuan indicated plainly that he had some doubts as to the identity of his Valley river with this branch.

(2) I think that the evidence amounts to a demonstration that (*a*) Low accepted the statements of the natives that Ossokmanuan had an eastern outlet, and that the discharge stream was called Valley river, but that Low had no information as to its course below the outlet and that the connection—in broken lines—was wholly supposititious.

(3) His narrative is ambiguous but the Indians were wholly ignorant of the existence of Frissell's "Grenfell" river.

As against Mr. White's contention that the name Valley River should be applied to what Mr. Frissell calls the Grenfell we may observe that in his report (p. 139) Low says: "Above the mouth of Bowdoin Cañon the main valley continues more than 10 miles . . . river in it has a moderate current. . . . It rises in Lake Ossokmanuan. . . ." When therefore he wrote the name Valley River against the outlet from the lake, he might be supposed to call it by this name because he thought it occupied lower down the main valley. Mr. White believes, on the contrary, that the name is a translation from the Indian name, and that we cannot draw any such inference.

Low says again, of Lake Ossokmanuan: "On the north side near the head of the upper island a branch called Valley River flows out. This stream is somewhat larger than the northern outlet, and constitutes the river which at present flows down the Hamilton river valley above its junction with Bowdoin Cañon." Mr. White considers that the information on the relative volumes is due to native information and not observation: but in the light of present knowledge it seems probable that Low was right in his fact, and in that case it may very we llbe argued that the river joining the Hamilton between Bowdoin Cañon and Big Hill Portage should be called neither the Valley river nor the Grenfell river, but the Attikonak.

THE PROJECTION OF THE INTERNATIONAL MAP

Projekcja miedzynarodowej mapy świata.— (*Odbitka z Polskiego Przegladu Kartograficznego*, Nr. 17.) **Antoni Lomnicki.** Lwow: 1927.

Matematyczna analiza projekcji mapy miedzynarodowej w skali 1:1,000,000.— (*Wiadomości Sluzby geograficznej*, Nr. 1.) **Antoni Lomnicki.** Wzrszawa: 1927.

IN these two papers—the first in English after a Polish introduction, and the second in Polish with a French summary—Dr. Lomnicki severely criticizes the projection adopted by the Conference of London for the International Map of the World on the scale of one in a million, a slight modification of the polyconic proposed by Lallemand, and proposes to replace it by a Conical with two standard parallels, from tables calculated on "Hayford's up-to-date measurements instead of Clarke's old-fashioned system." Since I am, in the author's words, a "fervent partizan" of the existing system I must do my best to repel Dr. Lomnicki's assault.

But first let me thank the author for pointing out that in my small book on Map Projections I have printed the tables for projecting this map from the erroneous tables originally published by the Committee, instead of from the corrected tables issued two years later. This is the less excusable since, if I remember aright, it was I who first discovered the mistake. The error may amount to as much as 0·17 mm.

Next let us admit that Dr. Lomnicki is quite right in saying that the Inter-

national Committee forgot to define the method of constructing the parallels other than those at the top and bottom of the sheet; that the meridians should not be divided equally, but in proportion to the true lengths of arcs of meridian on the spheroidal Earth; that the curves through the intermediate points thus constructed are not strictly circles; that the polyconic projection and still more its modification, is of little value in theoretical cartography; and that if we wished to apply Tissot's classic theory of deformations to the International Map we should have to calculate partial derivatives of very intricate formulæ.

All this is true, and profoundly unimportant, for no one need wish to treat a modified polyconic projection of an area 6° by 4° with such solemnity. Dr. Lomnicki's own calculations show that if we did abandon the present projection and substitute a conic with two standard parallels, and if we did use

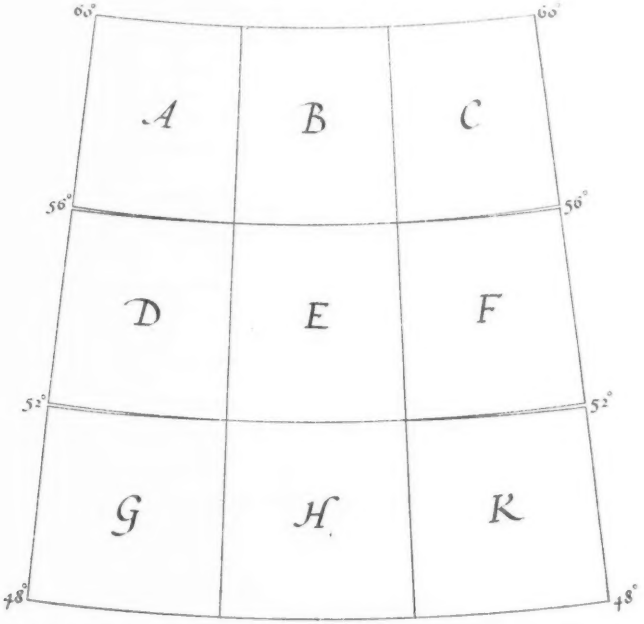


Diagram to illustrate the assembly of nine sheets of the 1/M map: the divergence of parallels is exaggerated

Hayford's figure instead of the "out-of-date measurements of an Earth ellipsoid given by Clarke in 1880," we should get results that are indistinguishable in drawing from those we have at present. It is therefore quite unnecessary to make any formal change. Those who like the secret satisfaction of using a projection that is more adaptable to the calculation of Tissot's indicatrix may do so with impunity: no one will be able to see in the result that it has made any difference at all. Those who like to make their maps of Poland with a figure of the Earth derived from measures in the United States, rather than with Clarke's figure of 1880, which did after all depend very much on the great

Russo-Scandinavian arc of Struve, that actually went through Poland, may do so even more securely: the height of the sheet will be changed by 0·01 mm.

But there is one point, and that the only one of any importance, in which Dr. Lomnicki is clearly wrong. He declares that "the International Projection suffers from a grievous defect, namely, that four adjacent sheets cannot be put together, either theoretically or in practice, without producing an interstice (an angular sector) in the margin amounting to 3 mm. in breadth at the equator and 2 mm. in the section in the map of Poland," while in Delisle's conical projection which he prefers, "when four or more sheets are joined together there are practically no interstices."

On the contrary, the four sheets adjacent to any sheet of the International Map can be fitted to that sheet exactly. Consider a block of nine sheets of the map, in three rows of three, and denote the four edges of any sheet E by *En*, *Es*, *Ew*, and *Ee*, where *Ew* signifies the western edge of sheet E. In the projection of the International Map *Bs* is identical with *En*; *Fw* with *Ee*; *Hn* with *Es*; and *De* with *Ew*. Thus the five sheets B, D, E, F, and H fit together exactly. The interstices or angular sectors of which Dr. Lomnicki complains arise from the fact that when the five sheets are thus so fitted, *Bw*, *Ew*, and *Hw* are not exactly in line. If the parallel dividing E and H is 52° the angle between *Ew* produced and *Hw* is 7′·8. Suppose now G fitted to D, the angle between *Ge* and *De* or *Ew* produced is the same, but in the opposite direction. Hence if G fits D and H fits E there will be an angle 15′·6 between *Ge* and *Hw*; or if G is fitted to H instead of to D there will be the same angle between *Ds* and *Gn*. They coincide at their eastern extremities, and at their western diverge by 1·86 mm. The same will happen to *Fs* and *Kn*.

Hence, if we consider the two rows of three sheets, D, E, F and G, H, K, they will fit along *Es*, *Hn*, but will diverge at the extremities by 1·86 mm. But if we consider only two rows of two sheets we may evidently tilt one row about the common point and make the divergence at each end of the row 0·93 mm.

Now suppose the two rows of three were on Delisle's projection as calculated by Dr. Lomnicki. *Es* would no longer fit *Hn* accurately. They are arcs of different radii, and if they touched at the middle points would diverge at each end by 0·23 mm. This is negligible, but since the divergence of the rows would evidently increase as the square of the difference of longitude from the central meridian it is easy to see from Dr. Lomnicki's figures that the ends of the rows of three sheets would in this latitude (52°) diverge by about 2·1 mm., as compared with 1·86; while if the rows were of two sheets instead of three the divergence would be 0·92 mm., as compared with 0·93, or almost exactly the same. If, then, we want to make a block of four there is nothing to choose between the two; but in a block of nine the International Map projection has a slight advantage.

What happens in practice when one tries to mount a block of sheets together is that none of them really fit along the edges where they should, owing to the irregular stretch of paper of different makings. By a little manipulation it is generally possible to make a sufficiently good fit of nine sheets; after that it breaks down, and would do so on either projection. A. R. H.

REVIEWS

EUROPE

Mediæval London.— **Gordon Home,** in collaboration with **Edward Foord.** London: Ernest Benn, Ltd. 1927. 8¾ × 5½, pp. 382. *Sketch-maps and Illustrations.* 18*s. net.*

THIS book continues the author's history of Roman London (see *Journal*, 67, p. 558) from the year 457 for over a thousand years, during the whole of which the population was mainly confined to the Roman walls and Roman suburbs. The same method is followed, the first part giving a continuous historic narrative, and the second attempting to reconstruct the life and social conditions of the Londoners. The limiting date chosen is 1485, when the mediæval epoch in England may fairly be said to close. Chronicles and records are, of course, far fuller from Anglo-Saxon to the beginning of Tudor times than during the period of the Roman domination, and the author's obvious love for his London has made the picture also fuller and more vivid. The several destructive fires of London have, indeed, left but few tangible and visible reminders of the mediæval city, which, prior to 1485, is represented mainly by stone structures; inscriptions on stone are actually fewer than in the Roman epoch. Reasons of space naturally prohibit a full treatment of Westminster or of the City's municipal constitution. What a tragedy it is that for a hundred and forty years after 457—when the landing of Augustine in Kent opens for us the history of mediæval London proper—we have no records, and no light from archæology! Alas! of the latter there is little likelihood, so deep, so confused, and so insignificant probably is the *débris*. But in 604, and throughout the seventh century, commercial London has revived somewhat, and is a market for many nations. Chapter i. sketches the fitful history till 851: London was still substantially a town of Roman buildings till the Danes under Rorik sacked and burnt it. In chapter ii. we reach 1066, and in the next seven chapters the story is carried on to the last phase of mediæval London. Reconstruction, of the type in which imagination starts from reasoning and facts, is a strong point with our author, and he gives a good sample of his skill in the chapters dealing with social, domestic, and religious life, and the external appearance of the city. He concludes with a capital chronology, which students will find useful, as they will the plan of London in the later Middle Ages and the bird's-eye view about 1570 by Braun and Hogenberg. Needless to say, detail is well illustrated by some excellent architectural photographs and by many drawings in the text. But the text itself is highly pictorial. If callous Londoners—and surely their name is legion—could be induced to read this book, they would take a new and justifiable pride in the realization that they are citizens "of no mean city." They would delight to think back to the great civic days of Whittington and Henry V. "Truly these were years of colour and pageantry at their apogee!" It is stimulating, too, to think of London under Henry VII. assimilating with avidity the New Learning as taught by Sir Thos. More and John Colet, or just beginning to assert its commercial supremacy among the cities of Western Europe. This close-packed narrative of 350 pages is instinct with life, incident, and colour. Major Gordon Home's telling of a wonderfully full, rich story is skilful and enthusiastic.

S. E. W.

The Wirral Peninsula: An Outline Regional Survey.— **W. Hewitt, B.Sc., Assoc. R.S.M.** University Press of Liverpool, Ltd.; London: Hodder

& Stoughton. 1922. $7\frac{1}{2} \times 5$, pp. x. + 294. *Maps and Diagrams.* 7*s.* 6*d. net.*

This book has two main objects: the first, to demonstrate the interesting relationship between the physical features of a small region and its past history and evolution; the second, to show in what departments further investigation is still required, and how the amateur may first begin his inquiry. In dealing with the first of these departments, the author is very successful. The history of the various communities is traced with accuracy and skill, and many interesting conclusions are drawn therefrom, although the author is somewhat handicapped by not having the full figures for the 1921 census available. The many interesting relics of a region which few would deem rich in this respect receive worthy mention.

The man who knows not the history of Wirral must be amazed at the wealth of evidence here produced. It is well known that there is a submerged forest at Meols, and that Chester was a flourishing port when Liverpool consisted of three houses; but here we find that Wallasey and Ince and Shotwick all have their tale to tell, and that it is not merely the prosperity of Liverpool which has brought increased population and repute to the Cheshire side.

Mr. Hewitt makes several suggestions which an enthusiast might follow up, among them the course of parish boundaries, and the history of the subordinate hundred of Caldy. The author has succeeded in producing a book which cannot fail to fascinate any one interested in the district, for every point of view receives attention. The geography (physical and political), geology, and history, are discussed in detail, while further chapters concern the agriculture of the district, and a useful list of local place-names and terms completes the book, which is accompanied by two maps, of the dates 1611 and 1818.

L'habitat rural de Belgique. Étude de Géographie humaine. M. A. Lefèvre. Liége: H. Vaillant-Carmanne. 1926. $10 \times 6\frac{1}{2}$, pp. vii. + 306. *Maps, Plans, and Illustrations.*

This is a book deserving of careful study by students of human geography on account of the method of treatment as well as the material dealt with.

It is arranged in four chapters, the first dealing with the manner in which the rural houses are distributed. Three types of distribution are described: agglomeration, dispersion, concentration, and this section of the book is illustrated by maps showing these types, taken from the 1 : 100,000 map of Belgium, and also by a generalized map of the distribution on a smaller scale (1 : 500,000). Having discussed the facts of distribution, explanation—historic, economic, and physical—of the facts is sought in a section of special interest. The section does not lend itself to quotation, but attention may be called to the paragraphs on p. 76 dealing with the Ardennes.

In chapter ii. the form and site of the villages is briefly discussed, while chapter iii. deals with density of buildings, and for this investigation "Les maisons proprement dites, c'est-à-dire celles qui servent effectivement le logement" are considered. It is interesting to note that in Belgium it is unnecessary to subtract the uncultivated land in making a calculation of density, as it is practically non-existent. The method is fully explained on p. 114, and the historical development shown by means of a map on p. 132.

Chapter iv. is perhaps the most interesting in the book. It deals with types of rural houses, which are discussed under the general headings of association, plan, and external aspect. Plans and drawings further illumine this section of the work in a most helpful way, and what Mme. Lefèvre describes as

the " maison-tricellulaire " receives full and careful treatment which must be most welcome to the student of human geography in other regions.

The volume is well illustrated. Maps and plans have been already referred to. A series of coloured maps illustrate matters dealt with in chapters i., iii., iv., and there is also a valuable series of photographs to which constant reference can be made while reading the text.

The book is pleasantly written and the intimate touches of description serve to show the careful study which has preceded the writing. Reference may be made here to the description of the roofing material in the Ardennes—schists whose weight demands a gentle slope ; the decoration of the modern brick house of Brabant by whitewash—a survival of the time when this was a necessity on account of the material used (p. 279) ; and this in Flanders (p. 267) : " La petite maison des dunes s'entoure d'un lopin de terre, jardin légumier, bordé d'un talus de 0·50 m. à 0·60 m. de haut, planté d'arbustes ou simplement de branches desséchées d'argousier. Ce talus est indispensable si on ne veut voir disparaître les cultures sous une couche de sable." G. M.

The Netherlands display'd, or the Delights of the Low Countries.— Marjorie Bowen. London : John Lane. 1926. 9 × 6, pp. xv. + 500. 12 *Plates.* 25*s. net.*

The important rôle often played by the Netherlands upon the European stage has enriched their history with great characters and memorable incidents, and to English readers its interest is increased by the frequent contact with our own history. Here is much and varied material for a writer with the eye for the picturesque which Miss Bowen possesses. Chapter by chapter she deals with each province in turn, varying the chronicles with more imaginative sketches. The details at times are rather too full, and without some previous knowledge of Dutch history the reader may be confused by them, but even a superficial reading of this book would repay any prospective visitor to Holland.

Die Landschaft von Valencia.— J. Sölch. (Extract from *Geographische Zeitschrift*, vol. **32**, 1926, pp. 337–359.)

By making it his first care to ascertain what published material was already available on his subject and then consulting it where possible, Professor Sölch has performed an act not merely of international courtesy but of ordinary common sense. He has added to our indebtedness by printing a bibliography of this material and giving abundant references to it in the text. This precedent might be followed with advantage in future articles on Iberian subjects.

The reader will do well, however, to distinguish carefully between the primary and secondary authorities quoted, and to remember that for reasons beyond his control the author has not always been able to point the way to the former. One or two notable omissions in the bibliography are also worth pointing out : The reports of the Junta Consultiva Agronómica, particularly the first of the two volumes dealing with irrigation, are vital primary authorities, while Markham's description of the irrigation works of Eastern Spain contains information not to be found either in these reports or in Brunhes. Carpenter's ' Greeks in Spain ' should be added for the identification of Hemeroscopeion (Appendix, pp. 117–26), and it also contains, like Obermaier's ' Fossil Man ' and Merriman's ' Rise of the Spanish Empire,' much information more accessible to the English reader than that in the relevant works cited.

From this abundance of sources (we stress the fact that there *is* an abundance) Professor Sölch chooses his material very wisely : there are no irrelevancies

and few sins of omission, but here and there improvements could be made. The collation of the Valencian plain with the Hungarian is more startling than fruitful, and must be addressed to some special class of reader; there is an occasional looseness, as in the reference to the Phœnicians in section V., or superficiality, as in the account of the geological history in section I., where a few additional words would have made clear the process by which the worn Miocene relief came to be covered by the later conglomerates; the author misses, too, the chance to say the vital thing about the late-Palæolithic rock-paintings, which is not that they are Aurignacian or Capsian, but that they include representations of the human form (the "Honey-gatherers," for example).

In avoiding the ordinary fault of "discovering the Mediterranean"—a fault which has become proverbial in Spain in this form—Professor Sölch has gone perhaps to the other extreme and suppressed his own personality only too completely. We miss in particular a traveller's legitimate impressions of the psychology of a class of industrialized farmers (the "industry of the waters"), and we miss the general summing-up emphasizing the inevitable limits imposed by the low rainfall on even this wonderful economy, limits which have recently been prominent in the disputes between the irrigators and the Municipality of Valencia.

This sketch may not be quite exhaustive in scope, but it is packed with good sound matter. And the author's modesty is disarming and most refreshing. R. A.

Guide to Majorca.— **Frederick Chamberlin.** (Official publication of the Fomento del Turismo of Palma.) Barcelona: Editorial Augusta. 1925. 7 × 4½, pp. xxiv. + 270. *Sixty-one Plates and Two Maps.* 5*s.* 6*d.*

The author of this guide still thinks it necessary to persuade would-be visitors to Majorca that they are not going to the back of beyond, though he does advise one to take "a common, cheap compass." This up-to-date work should, however, dispel all such fears. Besides a general introduction, historical sketch, and a description of Palma, a large number of tours are outlined varying from a three weeks' walking tour to as many days' motor trip. The map, on the scale of 1/200,000, hardly seems to give sufficient detail for cross-country walks or climbs, but it is supplemented by details in the text. It is not pleasant to read a lecture on the necessity of good manners on the part of Anglo-Saxons.

Switzerland from the Air.— With 262 illustrations from the collection of First Flight-Lieutenant **Walter Mittelholzer.** Edited and Prefaced by **Prof. Dr. Otto Flückiger.** Translated by **A. W. P. Allen.** Erlenbach-Zürich: Eugen Rentsch. 1926. 11½ × 9, pp. xxxii. + 176.

An oblique aerial photograph taken from a considerable altitude is intermediate in character between an ordinary ground photograph and a map. It shares in the disadvantages of each, but it also shares in their advantages. The representation is realistic and the line of sight may be near enough to that of ordinary life to render the photograph readily intelligible. Its view is more extended than that of a ground photograph, and the effects of perspective are less marked. There is no immediate foreground, and nearer features are not so greatly exaggerated relatively to those more distant. While in completeness and precision such a photograph cannot vie with a map, its realism and its extended field of view make it one of the best means of showing the general character of a country, especially in mountain regions.

The volume under review is an excellent example of the value of the method. It will be appreciated by all who are interested in Switzerland, and most of all by the physiographer. There are aerial views of towns and of the central lowland, but it is the photographs of the Alps and the Jura that form the most striking part of the book. It is impossible here to mention even a representative selection from the 258 photographs in the volume. From the physiographic point of view the advantages of the aerial photograph are conspicuously shown by comparing the views of the Mer de Glace and the Märjelen See with those to which we are accustomed.

Most of the photographs were taken by Mr. W. Mittelholzer, some by Mr. Suter of the Ad Astra Co., Ltd., Zurich. They are admirably reproduced upon plate paper and form a most interesting and instructive collection. There is an introductory text and a short account of each photograph by Prof. Flückiger, and there are reproductions of several old maps and views, including four striking bird's-eye views by F. W. Delkeskamp belonging to the early part of last century.

It would have been a convenience if, in addition to the descriptive account of each photograph, there had been a simple list with nothing but the titles. The translator has not always been judicious. In the text he entitles No. 258 "Ice-Sea." It is a photograph of the Mer de Glace. Though he translates this proper name, he speaks elsewhere of "kars," "kar-peaks," and "kar-basins" as if "kar" were a recognized English word. But such small blemishes do not detract from the value and interest of the volume.

P. L.

The Italy of the Italians.— **E. R. P. Vincent.** London: Methuen & Co. 1927. $7\frac{3}{4} \times 5$, pp. vi. + 244. *Illustrations.* 10*s.* 6*d. net.*

Mr. Vincent has a good knowledge of Italian and of Italian literature, which enables him to get easily into touch with the acquaintances chance may throw in his way, but it would require a longer residence and a greater familiarity with Italian life really to justify the title of his book. He sets out with the laudable intention of looking for the Italy of the Italians, which he differentiates from tourist Italy, rather than the usual sights, but his casual adventures differ little from those of other tourists, except that his knowledge of the language enables him to make the most of them. He has an eye for a scene, as we see in his descriptions of the Palio at Siena, for instance, and he is often off the beaten track; but he tends to be wordy and his humour often strikes one as a little forced. The reflections on Fascismo and one or two other subjects show to what good purpose he can put his understanding of Italian thought. Mr. Meo's illustrations add value to the book.

L. C.-M.

Poland's Economic Development.— **Prof. Francis Bujak.** London: George Allen & Unwin, Ltd. 1926. 9 × 6, pp. 67. *Map.* 3*s.*

The Scientific Institution for Co-operation in Cracow, which aims at furthering the economic emancipation of the Polish peasant by the promotion of co-operative ideals, includes a special publication department as a means to this end. This department is responsible for the publication of the book under review. This being so, it is surprising that so much of the work is concerned with the early economic history of the country, so little with the existing conditions and the co-operative activities of the people, and that it gives no consideration to possible further extension of these. The volume analyses in short outline the evolution of the country from the time of its great expansion in the fourteenth century, when communes, collectively responsible towards

the State, and trade guilds, were the basis of social life, through a period of transformation under the influence of German colonization, with limitations of State activities and greater individualism—a period marked by rapid development of a transit trade and the growth first of Cracow, at the crossing of the north–south and east–west trade routes, and then of Danzig—to that of the institution of the Corvée system, and the associated increase of the export of grain, flax, and hemp. So great was this increase that by the first half of the seventeenth century a third part of the arable land was concerned mainly in producing crops for export purposes. Both the beneficial and the detrimental results to Poland of this system of land culture are clearly shown, the latter including a marked decrease of interior traffic, increasing differences of wealth, and the growth of an anarchistic oligarchy. These unfavourable characteristics are directly traceable, at any rate in part, to the system of the corvée, and are typical of the period. They were brought fully to light by the wars of the middle of the century, when the legal status of the peasant fell to its lowest level.

The renaissance period under the last king of Poland showed the establishment of agricultural credit banks and grain depôts, and of industrial stock companies, and the simultaneous construction of two canals from the Baltic to the Black Sea—a proof of sound economic judgment. But the great economic progress merely hastened the Partition. Chapter vii. gives a short comparative account of the development of the subdivisions after the Partition, tracing the agricultural and industrial growth in Prussian Poland and the introduction of peasant proprietorship there, this increasing the productivity and consumption of the population in general. In Poznania and West Prussia the movement was associated with nationalism, the struggle for national survival resulting in great progress in agriculture and in its commercial organization.

Chapter ix. deals, in twelve pages, with the present situation, and might well have been considerably extended. As it stands it can give only the very barest outline of existing conditions, and matters of such vital importance as the composition of the population as regards nationality and social standing are merely mentioned. The importance of further agricultural development is shown, crop yields everywhere being low, and "land-culture" not having reached its pre-war level (p. 57). (Yet it should be noted that 1925 statistics show an increase of from 10 to 15 per cent. on pre-war crops.) Of equal importance is the improvement of communications. One feels that a much fuller treatment of the subject is essential, since, "in spite of excellent conditions for the development of land and water communication," existing means are far below the level that the economic life of the area demands, and, further, the recognized changes in relative positions of Poland's markets, with increasing importance for that of Czecho-Slovakia and a probable diminution of trade with Germany, necessitate a re-arrangement of traffic lines.

There is a supplement giving certain statistical data which were not available until after the completion of the book (1925 and 1926). B. H.

ASIA

A Spanish Franciscan's Narrative of a Journey to the Holy Land. Translated and edited by **Henry Charles Luke.** London: Palestine Exploration Fund. 1926. $8\frac{3}{4} \times 5\frac{1}{2}$, pp. viii. + 84. *4s. in boards; 2s. 6d. in paper covers.*

This is a brief but business-like account of what a sixteenth-century pilgrim was expected to see during a visit to the Holy Land. Indeed, it gives one the

impression of having been written less as a record of an actual pilgrimage than as a book of instruction for others. The writer seems to have been a Franciscan and a Spaniard. He was a traveller entirely without imagination. His journey was undertaken in or about the year 1555 for the purpose of seeing holy places. These he describes conscientiously but without enthusiasm: of his own feelings and impressions we know no more than if he had never lived. He ended his pilgrimage with the expedition to Mount Sinai, a journey so hazardous that it was said that no traveller ever lived to repeat the experiment. The Franciscan was jolted on a camel for thirty-four days, and something worthy of note must have occurred to him by the way, even if it was only acute discomfort, water shortage, or excess of heat. Yet all we have is the story of Elijah under the juniper tree and a reference to the caves and hovels of the Arabs. As against this we must set some brief but observant remarks on Loreto, Ancona, Venice, Padua, Crete, and Cyprus, and a short chapter on Cairo and Egypt. Mr. Luke has done the work of translation and editing most ably, and he claims importance for the narrative on the strength of the traveller's descriptions of places not much visited by pilgrims. This may be placing it a little too high in the list of pilgrim narratives, but it should certainly be noted by students. M. L.

The Seven Dwipas of the Puranas.— **V. Venkatachellam Iyer.** [Reprint in pamphlet form of seven articles contributed to a journal, title not stated.] Nellore, [N.D.] 9¼ × 7, pp. 74.

The historical and genealogical matter contained in the 'Puranas' has been laboriously collated and analysed by the late Mr. F. E. Pargiter in his 'Ancient Indian Historical Tradition' (1922). The geographical references therein still await comprehensive and critical treatment by some competent scholar. In the *Vayu Purana* (one of the oldest), for instance, there is a good deal of geographical detail that calls for careful examination, as it may shed some further light on the early movements of the so-called Aryans into India. In the articles reprinted in this brochure Mr. Iyer deals with one question, viz. the identity of the seven *dvipas*, a term translated by some as "islands," by some as "continents." The word *dvipa* really means land between "two waters," and is synonymous with the modern *doab*. How divergent have been the identifications hitherto suggested will be understood when it is stated that while one European scholar identified Pushkara with Iceland, another is satisfied that it was Mongolia; and Kraunca has been located in Western Europe as well as on the seaboard of China. The last word has not yet been said, but Mr. Iyer does much to help towards a solution. His treatment of the Kraunca legends is scholarly and ingenious; and his interpretation of *gomedaka* (*i.e.* "of Gomeda," a name applied to a gem, not definitely identified) as jade is important, and will probably be accepted. Gomeda, however, being substituted for Saka by three of the authorities quoted, rather points to the jade-mine country (the northern slopes of the western K'un-lun) being included in Saka dvipa; and it seems preferable to regard this, rather than Pushkara, as represented by the two Scythias of Ptolemy. It must be noted, moreover, that the imparting of geographical information is not one of the five subjects which we are told fell within the scope of the 'Puranas,' and recourse must be had to other Sanskrit works for clues to the localities to which these names were applied. It is to be hoped that Mr. Iyer will continue these researches, for which he appears to be specially qualified. C. E. A. W. O.

In British Malaya To-day.— Richard J. H. Sidney. London: Hutchinson & Co., Ltd. 1927. Pp. 311. *Photographs, Line Drawings, and a Map.* 21*s. net.*

In his previous book, 'Malay Land' (reviewed in the *Journal* of October 1926, p. 352), Major Sidney promised to complete his picture of Malayan life with another book on similar lines. Here he does so, and tells us something of Malaya's history, oil-palms, rubber, pineapple canning, tin-mining, and anti-malarial work, though he still omits to make reference to coconut cultivation and the opium traffic. Major Sidney was for some years headmaster of the Victoria Institution, Selangor, which is one of the largest schools for mixed Asiatics in the Peninsula, and he devotes several delightful chapters to modern educational methods in Malaya, showing the good work that is being done to enable those who are born in the country to attain the knowledge they require without being forced to seek it elsewhere. As in the previous volume, the photographs are excellent and the line drawings by a Chinese artist very effective; and we are glad to see that the author has adopted the suggestion made in the previous review, and has included an index and a map.

O. R.

Kinabalu, the Haunted Mountain of Borneo: An Account of its Ascent, its People, Flora, and Fauna.— Major C. M. Enriquez, 2/20 Burma Rifles. London: H. F. & G. Witherby. 1927. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xx. + 199. *Illustrations and a Map.* 10*s.* 6*d. net.*

This is the record of an expedition made in 1925 to Mount Kinabalu. Major Enriquez' primary object was to collect butterflies, but he tells us that as he approached "the majestic and awe-inspiring battlements of Kinabalu," he became more and more obsessed with a longing to reach the summit. The mountain was first climbed in 1844 by Sir Hugh Low, and the ascent, usually undertaken in three stages, presents no particular difficulties; in 1924 two District Officers of the Chartered Company discovered a new route for the first stage, and this Major Enriquez followed, climbing the first day to Lumu Lumu, 5500 feet, the second to Paka Cave, 9790 feet; the third to the tree limit at Sayat Sayat, about 10,500 feet; and on to the summit at 13,455 feet. Although the mountain has been explored by numerous naturalists and botanists, Major Enriquez found that of the 218 kinds of butterflies collected 134 were new to him; he also found one new species of moss and one new variety of a species, and two spiders which are new species, besides two which may require new genera.

The photographs of the summit are good, and the indices to butterflies, birds, insects, and plants mentioned are useful, also the appendices showing the distribution of butterflies. One could have wished, however, that Major Enriquez had not numbered his paragraphs consecutively throughout the book, in the manner of an official report, and that he had been content to confine himself to Kinabalu and his expedition: in his former books he has shown us that he can write delightfully, and he would have done better to have given us a fuller account of the expedition and to have included what might have been a fascinating chapter on the literature of Kinabalu, instead of devoting space to a necessarily inadequate and at times inaccurate description of the indigenous races of North Borneo.

O. R.

An Outline History of China.— **H. H. Gowen, D.D.,** and **Josef Washington Hall.** New York and London: D. Appleton & Co. 1926. $8\frac{1}{2} \times 6$, pp. xxx. + 542. *Map.* 15*s. net.*

The first half or more of this book is a re-written version of Dr. Gowen's previous volume; the second half is by Mr. Hall, and carries the record from the beginning of the Republic until the spring of 1926. It is the American reader for whom the book is written. The preface tells us that "the American people are reading less about Europe and more about Asia. They are coming to realize that the Atlantic is their neighbourly side door toward their relatives, but that the Pacific is their front door toward the world. Out of the five major ports of the world in point of tonnage China already possesses two." At the rate of recent increase Dr. Gowen prognosticates that "the bulk of America's foreign business will be with Pacific Asia by 1932."

The Chou dynasty, B.C. 1122–249, is described as "The period of Geographical Expansion," but that was really a process carried on, in successive waves, through all succeeding dynasties. With the exception of the Mongol period, it was under the late Manchu dynasty that the empire reached its greatest expanse. This meets with passing reference, though nothing is said of Yung Lo's remarkable expeditions to Western Asia early in the fifteenth century. On p. 46 we are told that the founder of the Chou dynasty changed "the capital to Sian-fu," while on p. 93 it is said that the founder of the Han dynasty in B.C. 206 "made his center of government the city of Sian, now for the first time the capital of China."

The principal chapter on Geography is chapter i., which gives a brief sketch of The Land and its Peoples. The translation of some of the names is too literal to be pleasing, and, *inter alia*, Shanghai does not mean "above sea," nor Feng-t'ien "favorable heaven." The Wu dialect is not only "spoken quite locally at Shanghai," but covers a wide area, and the affinities of Wenchow are to the Wu group rather than to the groups farther south. To be able to say that the "language barriers are perceptibly melting away" assumes keen powers of perception. How "the Chinese pressure . . . from the north-west" could "be responsible for the migrations that helped to people America" is not evident. Without entering into a consideration of the historical part of the work, one may congratulate the authors on being first in the field to tell the story of China from the beginning until last year. W. E. S.

Naturbilder aus Südwest-China.— **H. Handel-Mazzetti.** Vienna and Leipzig: Österreichischer Bundesverlag. 1927. 10 × 7, pp. xiv. + 380. 148 *Figures including* 24 *in Colours*, 1 *Folding Map. RM.*24.00.

The author of this well-produced volume is Keeper of Botany in the Natural History Museum of Vienna and, as he somewhat naïvely explains in the subtitle, was fortunate enough to carry out his botanical explorations in China when the Great War was raging in the world outside. The book is written in the form of an extended diary, the five main divisions corresponding with the five great seasonal journeys undertaken by the author. He left Europe in December 1913, and spent the year 1914 on the plateau and amongst the mountains of Yunnan and South-Western Szechwan. After a winter in Yunnanfu the 1915 season was occupied by a journey to the borders of Tibet; 1916 to the borders of Upper Burma. In 1917 a journey from Yunnan to Hunan was carried out, whilst 1918 was spent in Hunan. Regarded as a narrative of travel, the book is heavy reading, and the non-botanist will find the numerous references to vegetation rather trying. The great value of the

book lies in the immense number of careful botanical observations; it is a storehouse of information for those interested in the natural vegetation of China. The general features of the vegetation of Yunnan and some of the surrounding regions are already familiar to English readers from the writings of Kingdon Ward; the present volume supplies many of the details to complete the picture. A criticism which has frequently to be levelled against books of the type under review is that of lack of coordination of observations. Dr. Handel-Mazzetti escapes this criticism and an important feature of the descriptions of vegetation lies in the careful notes on elevation, soil, temperature, etc. The illustrations deserve a special note of appreciation; about half are mainly of botanical interest. Photographs of plant formations are frequently far from satisfactory owing to the loss of distinction between the different shades of green and the failure of the photograph to emphasize the splashes of colour which strike the eye; hence the coloured plates in the present work are particularly valuable. Those of alpine vegetation are especially striking. One leaves the book with the impression that the author has used his time well; he has made a vast number of bricks. But building has not been attempted, and a generalized account of the vegetation of China from the ecological standpoint is still a desideratum. L. D. S.

AFRICA

Through Wildest Africa.— **F. Ratcliffe Holmes.** London: Geoffrey Bles. 1925. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 318. *Illustrations and Sketch-map.* 16*s. net.*

Through Liberia.— **Lady Dorothy Mills.** London: Gerald Duckworth & Co., Ltd. 1926. $8\frac{3}{4} \times 5\frac{1}{2}$, pp. 240. *Illustrations and Sketch-map.* 15*s. net.*

Caravans and Cannibals.— **Mary Hastings Bradley.** London and New York: D. Appleton & Co. 1927. $8\frac{3}{4} \times 6$, pp. 319. *Illustrations and Sketch-maps.* 21*s.*

Cape to Cairo.— **Stella Court Treatt.** London: George G. Harrap & Co., Ltd. 1927. $8\frac{3}{4} \times 6$, pp. 247. *Illustrations and Map.* 21*s.*

Savage Life in the Black Sudan.— **C. W. Domville-Fife.** London: Seeley, Service & Co., Ltd. 1927. $8\frac{3}{4} \times 5\frac{3}{4}$, pp. 284. *Illustrations and Map.* 21*s. net.*

It is difficult to review books of travel of this type without much repetition, for although Africa affords unlimited scope for seekers after adventure, accounts of their experiences usually present a certain sameness. Once off the beaten track travel still entails a considerable amount of discomfort and actual hardship, and narratives of such journeys, unless undertaken for a specific purpose, are apt to be mainly a personal record of daily difficulties in obtaining porters and food supplies, of encounters with big game, and continual struggles with insect and other pests, while the country and its inhabitants are often relegated to the background. Judging from the number appearing every year such books have a ready public, but geographically and ethnologically they are of little value: the traveller new to the country will invariably see much that will interest him in the lives of the tribes through whose country he passes, but, however sympathetic, an untrained observer is unlikely, even if he has the desire, to obtain more than a superficial knowledge in the limited time at his disposal, while ignorance of language and cultural background too often leads to misinterpretation of such items of interest as he may acquire.

Mr. Holmes' journey through Central Africa was undertaken for the purpose of preparing his film *Kilimanjaro*, and he recounts his varied experiences and encounters with the wild animals he was endeavouring to film. The

country he describes is mainly in Tanganyika Territory, and includes the wonderful "crater" of Ngorongoro, which, over 30 miles in circumference, with its own rivers, swamps, forests, and jungles, forms a natural reserve estimated by one of Mr. Holmes' authorities to contain a minimum of 50,000 head of game, rising to three times that number in the dry season. The author devotes a few pages to the Wambulu, the people of Mbulu, a handsome race strikingly different in manners and physique from their neighbours and said to be descended from a band of twenty old men who journeyed southwards from a great lake, presumably Victoria Nyanza. Their girls are rigorously secluded for from six to twelve months after initiation. The Wa-Sanya are also spoken of, a primitive skin-clad tribe who hunt their game with bows and arrows which, being smeared with a virulent poison, are extremely deadly, though possessing a range of only 30 to 40 yards. The book contains some good photographs.

Lady Dorothy Mills' book is an entertaining account of her solitary journey through the hinterland of Liberia, a little-known area which she was the first white woman to visit. The usual difficulties in obtaining carriers were augmented in her case by the universal dread of the "Devil Bush," a kind of secret or masonic society that has a branch of varying formula in almost every Liberian tribe, whether Pagan or Muhammadan, the mystery surrounding the rites being complete and inviolate and the period of segregation for initiates varying from four weeks to as many years. Lady Dorothy describes the secret cannibal society of the "human Leopards" which still flourishes among the Manos and other tribes; the victim may be an unwary traveller or villager, carried off by force or lured into the bush by magic, while the bodies of those dead from natural causes are frequently dug up and partially devoured.

Mrs. Bradley also writes about cannibals, this time from the borders of the Belgian Congo, west of Lake Edward, where she and her party of six—including her eight-year-old daughter—penetrated on a hunting expedition, with the fortunes of which the book is mainly concerned. Mrs. Bradley gives a vivid description of their experiences with these friendly cannibals, and relates her conversation with one of their chiefs and various taboos with regard to the eating of human flesh. The party subsequently journeyed south to Lake Tanganyika through the Ruanda territory (now under Belgian mandate), and some excellent photographs are reproduced of the inhabitants of this district, the Wahuti and their handsome aristocratic conquerors the Watusi.

Major and Mrs. Court Treatt with three others attempted the first journey by motor car from the Cape to Cairo, and successfully carried out this feat in the face of almost insuperable obstacles. Through the greater part of the area covered, roads were non-existent, and bridges, if there were any, were native-made affairs which had to be partially rebuilt before they were fit for the passage of a heavy car. The entire journey took sixteen months, and four of these were spent on one stretch of 380 miles between Bulawayo and Dett (the party were here overtaken by the rains), where the daily rate of progress rarely exceeded 6 miles, and this mainly by dint of hauling the cars with block and tackle through the axle-deep mud and swamp, until at last in desperation the party left the lower ground and took to the hilltops, through the dense forest of which a passage had to be cleared yard by yard. In the Southern Sudan the cars had to be hauled by natives across rivers sometimes 20 feet deep or more, and it was in this district that the greatest difficulties were encountered, these being enhanced by the extreme unwillingness of the inhabitants, especially the Dinka, to be of any assistance. The illustrations give

a vivid idea of the mishaps and adventures that befell the expedition, and though the practical value of such an enterprise may be doubted, the extraordinary pluck and endurance displayed could hardly be surpassed, while the fact that both the Crossley cars reached their destination is a tribute both to the makers and to the skill and resource of the drivers.

Mr. Domville Fife's book differs from the above volumes in that it purports to be concerned not so much with his own experiences as with the habits and customs of the inhabitants of the territories visited. Mr. Fife visited Kordofan and the Bahr-el-Ghazal, and had the opportunity of accumulating a mass of information concerning the little-known natives of these districts, but his account, written in a popular, even sensational style, is of less value than it should be. The author's zest for adventure sometimes carries him away and leads him to exaggerate the dangers incurred, for instance, in his account of a Shilluk dance of which he was a witness, he writes that he had " very foolishly neglected to bring any weapon other than a small revolver and a . . . sword-stick "—he does not however state what armament he would consider appropriate. Mr. Fife spent a considerable time among the Nuba of the Nyema Hills in South Central Kordofan, and his Nuba photographs probably constitute the most valuable part of his book. C. G. S.

History of the First Twelve Years of the Reign of Mai Idris Alooma of Bornu (1571–1583), by his Imam, **Ahmed ibn Fartua,** together with the ' Diwan of the Sultans of Bornu ' and ' Girgam ' of the Magumi. Translated from the Arabic with Introduction and Notes by **H. R. Palmer,** sometime Resident of Bornu Province. Lagos: Government Printer. 1926. Pp. iii. + 121. *Map.* *7s. 6d. net.*

The geographical position of Bornu has rendered it a region of great interest to the ethnologist and the historian. Lying at the southern terminus of Saharan caravan routes it has always been within touch of Mediterranean civilization. Situated midway between the Nile and the middle Niger, it has been an important channel for the cultural influences which have inspired the virile peoples of the West. If the kingdom of Bornu failed to rise to a position comparable with that attained by Songhai and other western states, it never lost political importance, and it escaped the utter obscurity into which its greater neighbours so quickly sank.

Consequently Bornu history makes a wide appeal, and the present work merits the attention of all who are interested in either the western or the eastern Sudan. The Arab manuscript here translated by Mr. H. R. Palmer is one of the many good things we owe to the researches of Barth. He discovered the manuscript in Kukawa and sent it to the Foreign Office, whence it mysteriously disappeared. It was re-discovered in Germany in 1921. Its chief value lies in the picture it gives of life in Bornu during the latter half of the sixteenth century. The narrative is chiefly confined to the wars of Mai Idris, who employed Turkish musketeers in his army, and gives a good idea of the intense human misery caused by relentless and interminable war between Moslem and pagan. Conditions in Bornu appear to have altered little between the time of Mai Idris and the early explorations of Clapperton and Barth.

Mr. Palmer's copious notes are by far the most valuable part of the work. In preparing these he has drawn lavishly upon his own great store of knowledge of the history of this region, to the advantage of the student. Bornu was in intimate touch with many of the tribes of the Sahara with whom the people had close racial ties. Mr. Palmer has added considerably to our knowledge of the

early history of some of these desert tribes, and has suggested lines of inquiry along which further research may prove fruitful. The Roman penetration of the interior of Africa and the former range of the Christian religion in the Sahara are two subjects of general interest on which he makes valuable observations. The work, however, will be of more particular concern to those interested in the history of Bornu and the neighbouring Hausa country.

It is difficult to understand why a very indifferent map of the railway systems of the northern half of the continent should have been chosen for a book which deals with nothing later than the sixteenth century. Nor does this poor map give all the place-names found in the text. One has learnt to expect something better than this from the enterprising Survey Department of Nigeria.

E. W. B.

What about North Africa? Travel in Morocco, Algeria, and Tunisia.—Hamish McLaurin. London: Charles Scribner's Sons. 1927. $7\frac{3}{4} \times 5$, pp. xiv. + 362. *Illustrations.* 12*s.* 6*d. net.*

This conveniently sized volume is intended, not to rival the tourist agency or the guide, but "to give the prospective tourist an idea of what he is likely to see if he follows the advertised routes of travel, so that he can judge for himself to what extent he may expect to enjoy the experience." If the said tourist is not attracted to North Africa by this book, it is certainly not the fault of the author, whose enthusiasm is evident throughout. He might however have refrained from such headings as "Facts about Sfax," "Sousse for the Scholar," and the like.

Die Schilluk: Geschichte, Religion und Leben eines Niloten-Stammes.— Nach **P. Banholzers, F.S.C.,** und eigenen Aufzeichnungen dargestellt von **Wilhelm Hofmayr.** Verlag der Administration des Anthropos, St. Gabriel, Mödling bei Wien. 1925. $10\frac{1}{2} \times 7\frac{1}{2}$, pp. xvi. + 521. *Sketch-maps and Plates. G.M.*20.

Father Hofmayr has produced the first monograph on a Sudanese tribe, for although the Shilluk have been more written up than any other people, no attempt has been made by any previous writer to describe more than their astonishingly interesting politico-religious organization. Hence the present volume constitutes a valuable addition to our knowledge of the Nile valley. Although the account is supplemented by the author's own observations made during his ten years' work at Tonga and at Lul, and by those of some of his fellow-missionaries, he seems to have depended for the bulk of his material on the notes of the late Father Banholzer whose mission was at Lul, not far from Fashoda; and in this connection it should be noted that there are probably differences between the northern and southern portions of the Shilluk kingdom (indeed, the two halves at one time waged war on each other)—a fact which may account for certain omissions.

The Shilluk, who more than twenty years ago were numbered at 40,000 in a census which was probably incomplete, occupy the flat grass territory on either side of the Nile from Kaka to Lake No on the west bank and from Kodok to Taufikia on the east bank, their villages extending some 35 miles up the Sobat River, principally on the north bank. A number of Uganda tribes, such as the Acholi or Gang, the Lango, and the Alur, speak dialects of Shilluk, and it seems probable that the "cradle-land" of the original stock lay between Lake Victoria and their present territory, offshoots taking place in both directions; in any case, a migration or series of migrations gave rise to a tribe or body of tribes speaking a Shilluk dialect in the Bahr-el-Ghazal

Province, and it is from one of these that the Shilluk nation has emerged. One of the most interesting facts brought out by Father Hofmayr is the relation of the Shilluk to the Jur, for his account leaves little doubt that the Jur of the Bahr-el-Ghazal Province represent the remains of what was once a greater Jur people from whom are derived the present-day Shilluk, or, more accurately, a certain number of their leading families, including that of the king. Tradition tells how Nyakang, the leader, culture hero, and first king of the Shilluk, having quarrelled with his half-brother Duwat, left the country of his fathers and with his followers migrated to the Land of Dimo or Turro—between the Nile and Bahr-el-Ghazal river, called Wifach by the Shilluk—where his half-brother's son, Dimo, was already established. The two dwelt peaceably together until the jealousy of the latter drove Nyakang and his adherents to seek fresh homes in the east, and so brought into existence the Shilluk nation, while Dimo and his people moved west, remaining as Jur in their present country.

There is an enormous amount of folklore concerning Nyakang. Father Hofmayr gives a list of his twenty-five synonyms, and records the Shilluk tradition that he died in no ordinary way, but disappeared in a whirlwind during a festival; he is incarnate in every Shilluk king, in certain animals and trees, and from time to time, especially during great festivals, his spirit takes possession of the *baret* (priests of the royal shrine), and through them communicates again with his people. In spite of the magic and myth surrounding his name there seems no doubt that Nyakang was a real person. His sons Chal and Dak, who succeeded him, are also regarded as semi-divine and as having disappeared from earth; and in ancestor worship Dak ranks next to Nyakang. Father Hofmayr gives a genealogy of the royal house which differs from those of previous inquirers, and on account of his excellent panel of native informants should be accepted as authoritative, while he also gives a history of the reign of each of the twenty-nine kings, down to Papit, the present monarch.

The king is absolute ruler of the whole country, but his sovereignty is largely exercised through the high chiefs of the areas into which the realm is divided, and during the year of mourning which must elapse between the death of a king and appointment of his successor, one of these chiefs acts as regent. The new king is elected by the chiefs from among the members of the Royal House, and the news of their decision is conveyed by night to the king-elect by one of the chiefs, who engages him in a sham fight, this being theoretically the first indication of his election. This seems to point back to a time, still remembered in Shilluk folklore, when any one of blood royal who could kill the king himself became ruler. The wives of the new king do not accompany him to Fashoda, the royal burgh, but he has to procure a fresh harem, and also inherits the wives of his predecessor, his late wives being made over to his eldest son. At his installation the spirit of Nyakang becomes immanent in the king, and one of the fires kindled by friction at this ceremony is the life-token fire of the new ruler, a brand of it being carried to Fashoda; nor must it be extinguished during his lifetime.

The king is also the high priest of the country, the mediator between people and Nyakang, and, as the incarnation of Nyakang, the rainmaker. During a drought the king may, as a last resource, order the sacrifice of a man or boy, the sacrifice being carried out by the *ajwogo* (medicine man).

The observations on totemism are an important contribution to our knowledge, although the example recorded by Father Hofmayr is derived from Tonga in the extreme south, where, since Shilluk-Dinka marriages are not

uncommon, the Shilluk may have been influenced by Dinka totemism. On the other hand, the relatively small number of totem animals noted would seem to imply a wide distribution of the totem clans. It may however be pointed out that while exogamy is generally observed, that part of the totemic complex which emphasizes the association of particular groups of men and animals seems to make no great emotional appeal to the Shilluk as compared with the feelings that the same ideas evoke among the Dinka.

The sections on religion are among the most interesting in the book, beginning with a discussion of the meaning of the word Jwok (Juok) among the Shilluk and those tribes speaking related languages which are sufficiently well known to permit comparison. The functions of the *ajwogo*, the priest of Jwok, are also dealt with at some length and compared with those of the *baret*—the keepers of the temples and priests of the ancestor cult—of which the king is the chief.

It has been possible in the limited space available to touch on only a few of the subjects dealt with in this important work, which, on the historical side especially, is likely to remain long the standard authority. The book closes with a most useful corpus of songs, and with a number of plates and technological diagrams. C. G. S.

AMERICA

Newfoundland.— **Don C. Seitz.** London: George Allen & Unwin. 1927. $8\frac{1}{2} \times 5\frac{3}{4}$, pp. xii. + 252. *Illustrations.* 12*s.* 6*d. net.*

This book, whose author is described on the wrapper as an American "Journalist-Historian," begins with a short summary of the history of Newfoundland, in which there are some inaccuracies in the dates. The name "Vaughan" is repeatedly mis-spelt, while, strangely enough, the summary ends with the reign of Charles I. Mention is afterwards made of religion and charitable work, of the cable which comes to land at Heart's Content, of the island's resources, sport, Government and politics, the Newfoundland dog, and of course of the greater industries such as fishing, sealing, paper-pulp manufacture, and the "Wabana" iron ore.

Mr. Seitz's strictures on the treatment and waste of the "harvest of the sea" are to some extent borne out by Mr. M. E. Condon's booklet on the subject, and by the Report for the past year of the Council of the Newfoundland Board of Trade, though we read here that some improvement has recently been effected. In his statements as to the value of the coal and mineral resources the author is simply repeating an old and oft-told tale. The reviewer was in Newfoundland when some 8000 tons of the native coal were subjected to a working test on the railway, and heard the disparaging remarks of the engine-drivers thereon. Since then hardly any has been mined, though this year the Government is helping in drilling operations on the coal-measures of the Barrachois River. Perret in his 'Géographie de Terre-Neuve' describes the coal of the island as little better than lignite. The only proved mineral asset of the colony is the valuable and cheaply handled iron ore of Bell Island, and there is little probability of its ever being a rich mining land. Nevertheless, the development of the zinc-lead undertaking on Red Indian Lake will be watched with interest.

The author is fully aware of the terrible ravages caused by the paper trade, to remedy which re-afforestation is at present only being "considered"! Both for the forests and for some of the other natural resources strict conservation is essential; certain steps have been taken in this direction, but much

more should be done, and that quickly. In the chapter on Labrador, which he did not visit, the author does not add to our knowledge of "the land that God gave Cain."

Although the book is quite readable the student must still refer to earlier works like those of Judge Prouse, Perret, Millais, and Dr. Grenfell, as well as to the Annual Report to which reference has been made above. That Report proves that our brethren of the oldest British colony are not so unenterprising and backward as some would have us believe.

The book is well illustrated, but wants both index and map, and the British reader will doubtless take exception to the author's remarks on pp. 35 and 206.

G. D. McG.

Llama Land: East and West of the Andes in Peru.— Anthony Dell. London: Geoffrey Bles. 1927. 10 × 7½, pp. 248. *With Illustrations from Photographs by the Author.* 30*s.*

In Peru, more than in most countries, Nature in all her strikingly contrasted aspects defies man to bend her to his will. This dominance of Nature has been challenged in recent years, but how little either the most modern Peruvians or the foreign capitalists they have called upon as allies have so far accomplished in the struggle is well brought out in this book, rather by implication than by direct exposition. Mr. Dell in the journeys he describes travelled along the two most populous "corridors" in Peru, but even so he found the untamed wildernesses hemming him in on every side and frequently breaking across his path.

The book is pleasing in general get-up and is agreeable to read. Though the writer has little that is really new to tell, he carries us with him easily into the company of all sorts of people, whether cultivated city dwellers of the coastal plain, poverty-stricken plateau Indians, or hardy muleteers on the trails down into the Montaña. With a similar lightness of touch he gives us glimpses also of the flora and fauna as observed by a nature lover who does not profess to be a trained naturalist.

Of purely geographical material, however, the book contains unexpectedly little—not even a serviceable map. It scarcely justifies its title, since it deals far more with the people, how they live, and what is being done (or being left undone) for the development of the country than with the country itself. Mr. Dell has perhaps acted wisely in giving the geographical aspect a subordinate place in his book, having at the outset committed himself to following well-beaten tracks; but his theme is rather slight. The weakness of books of this type lies, indeed, in the fact that it is impossible to collect much useful new material or observe scientifically, on a hurried tour through an unknown country unless one has the genius of a Darwin. Thus the narrative tends to devote itself unduly to a recital of the traveller's experiences without reference to some larger plan. The telling of these must be well done indeed if, having failed to add anything appreciable to our stock of human knowledge, it is to rise to the height of literature.

This having been said, it is proper to add that Mr. Dell has written a distinctly good travel book. The twenty-four illustrations are well chosen, and their execution adds much to the artistic appearance of a handsome work, which should be of interest not only to those who have travelled or are about to travel in Peru, but also to many who, not being able themselves to see and to admire, must be content with the descriptions of others.

E. W. S.

A Botanist in the Amazon Valley : An Account of the Flora and Fauna in the Land of Floods.— R. Ruggles Gates. London : H. F. & G. Witherby. 1927. $7\frac{3}{4} \times 5$, pp. 203. *Eleven Plates, one Folding Sketch-map.* 7*s.* 6*d. net.*

It is one of the advantages of the modern rapidity and ease of ocean travel that the academic student of science is able to go far afield even in the limited time available during a University vacation. The value to the botanist or zoologist of seeing for the first time plants and animals of other climates in their natural habitat is undeniably great, but such a short acquaintance is apt to prove a slender basis for a book on the flora and fauna. Prof. Gates' trip was by ocean liner to Manaos, and by river steamer from Manaos to Teffé and back ; the whole journey from and to England occupying about ten weeks. The scientific reader will not find much which is new in the present work : indeed, many of the author's observations are of doubtful utility or validity. He is surprised that " although it is less than $1\frac{1}{2}°$ south of the equator, yet Parà has a relatively equable climate." On p. 79 he describes a typical lateritic soil without recognizing it. At the same time he does not hesitate to pronounce judgments on matters zoological, anthropological, and economic. He devotes a whole chapter to " The People," drawing conclusions from the most superficial of observations. The book seems to have been written in great haste, and apart from such obvious errors as the use of a plural verb with a singular subject, the reader may rightly object to the kaleidoscopic jumble of past and present tense, first and third person, the plentiful sprinkling of common Portuguese words acquired during the voyage, and the oft-repeated use of colloquialisms and such adjectives as " hard-bitten." Nor is the book redeemed by its illustrations, few of which seem really to show what is intended. L. D. S.

HUMAN AND HISTORICAL GEOGRAPHY

The Cambridge Ancient History. Vol. 5. **Athens. 478–408 B.C.** Cambridge : University Press. 1927. $9\frac{3}{4} \times 6\frac{1}{2}$, pp. xxii. + 554. *Maps.* 21*s. net.*

This volume is devoted to the history of Greece during the fifth century B.C. which centres around Athens and the Athenian Empire. It appropriately opens with a chapter by Mr. M. N. Tod on the economic conditions of the Mediterranean world in the fifth century, accompanied by a map showing at a glance the districts where the chief food products, metals, woollens, timber, etc., were produced, and which serves to illustrate the agricultural, industrial, and commercial problems that characterized the period, and especially affected Athens. In the next three chapters Mr. E. M. Walker treats of the Confederacy of Delos and of Athens in the age of Pericles. The story is continued by Prof. Adcock with an account of the Archidamian War and Peace of Nicias. The State of Athens during the last years of the century and the fall of the Athenian Empire are described by Prof. W. S. Ferguson, who also gives a graphic account of the Athenian expedition to Sicily. The reader is enabled the better to follow and understand this tragic story by a chapter on Sicily in which Mr. Hackforth continues the history of the island from the point where he left it in a former volume.

But what will make this volume particularly attractive to many readers are what may be termed the chapters subsidiary to the history proper. These chapters contain four essays of intriguing interest. The Attic Drama in the fifth century, by Mr. Sheppard ; The Age of Illumination : the Sophists and Life and Death of Socrates, by Prof. Bury ; Herodotus and Thucydides, by

Dr. Macan; and finally Greek Art and Architecture, by Prof. Beazley and Mr. Robertson, unfortunately not yet accompanied by the illustrations so necessary for a full appreciation of the subject. These are promised in a volume of plates to be published later. The Phil-Hellenism of these essays is infectious, and one only regrets that limitations of space have prevented their being longer. They are sufficient, however, to illustrate "the Glory that was Greece." Since the writers of this volume owe so much to the pages of Herodotus and Thucydides, Dr. Macan's quite Plutarchian discourse is most appropriate, and his eulogium will find a ready response from every lover of history, from every lover of Greece. "With Herodotus and Thucydides," he remarks, "history as an art was born, indeed twice born, in romantic and classic perfection, and to their supremacy as literary artists may be ascribed the triumphant survival of their works. . . . Though working on very different lines, they were both alike creative historians and consummate literary artists. The historical value of their works, each in itself, still more if taken together, is past easy appraisal."

The reader is assisted in following the narrative by eleven clear outline maps, and the student wishing to pursue the subject further will be grateful for the Bibliography, which extends to no fewer than forty pages.

E. A. P.

GENERAL

The Papers of Thomas Bowrey, 1669–1713.— Part I. Diary of a six weeks' tour in 1698 in Holland and Flanders; Part II. The Story of the *Mary Galley* (1704–1710). Edited by Lieut.-Colonel Sir Richard Carnac Temple, Bt. London: Hakluyt Society. 1927. (Second Series, No. LVIII.) 9 × 5¾, pp. xx. + 398. *Maps and Illustrations.*

The papers now admirably edited were discovered by Mr. John Humphreys in 1913 at Cleeve Bior, near Evesham, and their possessor is Lieut.-Colonel Henry Howard. As carefully arranged, introduced, and annotated, they make fascinating reading. Thomas Bowrey, merchant and traveller, was one of the vigorous pioneers by whose labours the British Indian Empire came into being, who foresaw Britain's commercial supremacy and the establishment of her colonies, and made it one of their chief objects to plant the English flag in remote regions, "one of those adventurous spirits who were worthy successors of the great Elizabethans." Part I. gives his diary of a six weeks' tour (in 1698) in Holland and Flanders in his yacht *The Duck*—a very energetic holiday—and includes his sailing directions about the mouth of the Thames, along the Essex and Kent coasts. In Part II. we have the story of one of his ships, the *Mary Galley*, from her construction in 1704 to her capture by French privateers in 1707, and the final settlement of her accounts in January 1710—a story containing unique information. For we learn the entire history of a small mercantile ship in the early eighteenth century, the contract for building her, the specifications and accounts of her construction, her voyage to Java and India, and her capture on her return in August 1707 when she was taken into Dunkirk and her crew imprisoned. This Odyssey is of great interest and value, and many are the intriguing accounts of famous towns as they were over two centuries ago. Here is a case (p. 42) of a punishment ingeniously made to fit the crime. In Amsterdam the Rasphouse was a prison in which work-shy were set to rasp hardwood. Those who refused to work were put into a cellar into which the water ran. "If they will pump hard, they keep the water low; if not it rises and drowns them."

S. E. W.

Das Erdbild der Gegenwart.— Herausgegeben von **Dr. Walter Gerbing.** 1. Band. **Europa.** Leipzig: List und von Bressensdorf. 1926. 10 × 6, pp. xvi. + 912. *Illustrations and Sketch-maps. RM.*35.

Allgemeine Geographie: zur Einführung in die Länderkunde. Länderkunde. (Ein Handbuch zum Stieler.) **Hermann Lautensach.** 2 vols. Gotha: Justus Perthes. 1926. 10 × 8, pp. x. + 435; xiii. + 844. *Illustrations, Maps, and Sketch-maps. Two volumes, £3 12s.*

These latest additions to the already considerable number of German general geographies naturally present many resemblances to each other, though the treatment and the amount of detail are not identical. 'Das Erdbild der Gegenwart' is the more popular in character, and also the more extensive, for this bulky volume covers Europe only. It aims at describing the varied scenes of human activities to-day, with sufficient explanation to make them intelligible to the general reader. Though it is not perhaps quite fair to take the section on the British Isles as typical, a brief analysis will make the general character of the work clear. The writer, Dr. Halbfass, first discusses the world position of the islands, their physical features, structure, and climate; he then gives an outline of the economic situation, and concludes with a brief characterization of English city and rural life and a hurried excursion through the countryside. Throughout he makes many references to examples familiar to German readers. The various sections are rather isolated, so that the causal relations are not strongly emphasized. Some passages give the impression of having been compiled from the map, and indeed much of the earlier information could be as easily obtained from the study of an atlas. It appears however, from the concluding sections, that the writer has at least visited these islands, though his remarks are sometimes superficial, and support the conventional continental view of English life. There are several misprints in the topographical names. The German section is naturally the longest, and the country is treated regionally. It is inspired by the conviction that, to improve their present position, Germans must realize both their country's limitations and resources. The Rhine valley is treated as a whole, as is no doubt fitting, but exception may be taken to the statement that of the Germans beyond the Reich's boundaries, one and a half millions are in France. It is much to be doubted whether the citizens of Strasbourg regard themselves as mere step-children of France.

Lautensach's 'Handbuch' is rather supplementary to, than explanatory of, Stieler's atlas. The general volume does not deal specifically with maps, with their construction or use, or with what may be learnt from them. It covers rather the "Nachbarwissenschaften." Its scope will be realized from the fact that it is approximately equally divided between physical geography and anthropogeography, if that cumbrous term must be used. The second and descriptive volume, Länderkunde, avoids what may be more easily shown on a map, so that there is little topographical description and historical explanations. It is therefore largely ethnological, or better perhaps, racial, economic, and political. To bring the world within one volume, one-third is devoted to Central Europe, and a quarter of the remainder to the rest of Europe. The possibility of the British Empire becoming self-supporting economically is a matter of interest in both works. Both are illustrated, and there are many sketch-maps.

Atlas Geograficzny. Stanisław Korbel i Ludomir Sawicki.— Kraków: Nakladowa Ksiegarnia Geograficzna "Orbis." 1922–25. 12 × 10.

Kozenna Atlas Geograficzny dla szkoł srednich, zawodowych i seminarjow nauczycielskich opr **J. Heiderich i W. Schmidt,** spolszczyli **B. Gystawicz i**

J. Mazurek. Wydnie szóste, opracowat i uzupełnit **Tadensz Radlinski.** Warsaw: Gebethner i Wolff. 1926.

Powszechny Atlas Geograficzny.— Eugenjusz Romer. Lwow-Warsaw: Ksiaznica-Atlas. 1925. 12 × 8.

Atlas Statystyczny Polski.— Dr. J. Weinfeld, E. Szturm de Sztrem, i Dr. J. Piekałkiewicz. Warsaw-Bromberg: Instytut Wydawniczy "Bibljoteka Polska." 1925. 14 × 10.

The first of these atlases was originally published in parts, beginning in 1922, and appeared as a complete work in 1925. It has obviously been designed for a school course involving a careful study of the geography of Poland, other parts of Europe in less detail, and the rest of the world in outline. The section dealing with Poland will undoubtedly constitute its chief attraction for non-Polish geographers, because in addition to the general maps of that country, and inset maps of all its chief towns, there are folded sheets containing no fewer than twenty-four small maps dealing with almost every subject of geographical interest—morphology, climate, economic conditions, race, religion, etc. The whole work is beautifully executed, and a study of it leaves a most favourable impression of the possibilities of Polish cartography. The representation of the physical geography of Poland is particularly good, and in many of the distribution maps the choice of colours is admirable. One criticism must, however, be made, and it is a serious one. The maps are in most cases too small (the scales vary from 1/3 M to 1/300 M), and the lettering is so fine that even for a person with fairly good eyesight a reading-glass is essential.

The second atlas in the above list is a translation of a German school atlas which was originally compiled by F. Heiderich and W. Schmidt and translated into Polish. It has since been amplified by T. Radlinski and is now in its sixth edition. The maps, which have been produced by Hetzee in Vienna, number forty-five; of these about half are devoted to Europe, and the remainder are divided in almost equal proportions between the other continents and the world as a whole. There are numerous inset maps, some of which, at least, are of interest. The atlas will, no doubt, prove useful to Polish students, but the technique shown in its production is not of a high order, and the work as a whole is inferior to the best German school atlases.

Romer's atlas, too, is not altogether satisfactory. A few astronomical diagrams, some charts of the world showing various distributions, several maps of Poland, and physical and political maps of the continents, constitute the bulk of the work. The maps of Poland are fairly good, but in general the draughtsmanship and lithography are not up to the standard of the work first noticed.

The Statistical Atlas of Poland, of which as yet only two parts have been received, has as its object a comprehensive survey of the political and economic activities of the people of that country. It contains much useful information on a great variety of subjects—for example, population, education, utilization of the land, mining, banking, language, and religion—and its value is enhanced by a comparison with the state of affairs in 1913 on the one hand, and with contemporary conditions in the chief European countries on the other. Most of the information, it must be admitted, is given in the letterpress; the maps are not very illuminating, and consist in the main of circular and rectangular diagrams placed within the provincial frontiers and indicating for each subject dealt with the proportion for the province of the total for the whole state.

J. McF.

THE MONTHLY RECORD

EUROPE

Land Reclamation in Italy.

THE large proportion of unproductive land in Italy gives unusual importance to the question of reclamation, particularly of lands hitherto uncultivated on account of their water-logged nature. Such reclamation has already made great progress, though the extent of the operations is perhaps hardly realized outside Italy. The history and present position of reclamation in a particular area—that round Ravenna and Ferrara, are dealt with in detail by A. R. Toniolo in the February 1927 number of *L'Universo*. As lately as 1860 it was reckoned that 20,000 square kilometres, mainly in the neighbourhood of the coasts, were marshy, malarious, and unproductive, but of these 10,000 have already been reclaimed, while 6000 more are being dealt with, leaving only 4000 still in their primitive condition. In the area under consideration, the immense deposits brought down by the Po and other rivers have favoured the formation of lagoons along the coast, and the process has been intensified by the gradual lowering of the land relatively to the sea, so that large areas are below mean sea-level. Sig. Toniolo gives a map on which the contour lines are drawn at intervals of 5 metres, thus bringing out well the form of the surface and its relation to the courses of the rivers. The 20-metre contour is important, dividing the area of fairly rapid slope, in which the rivers still act as eroding agents, from the nearly level depressions in which the resulting material is deposited. Reclamation is however confined in the main to the area below the 5-metre line. Although some beginnings of cultivation were no doubt made by the early inhabitants who, as Strabo tells us, raised embankments to protect the newly emerged lands on the borders of the lagoons, it was with the rise of Ravenna, on the fall of the Western Empire, that the first really important works were begun, but with the decadence of the city they fell into decay, while Venice thought rather of the maintenance of free waterways than of the interests of the agriculturists. In the Ravenna district, no great further advance was made till the sixteenth century, when, in 1531, Pope Clement VII. appointed Lorenzo Salviati to work out a scheme of reclamation which later had the support of Gregory XIII. and became known as the Gregorian. But it was not till the middle of last century, after much damage had been done through the vagaries of the river Lamone, that the idea took shape of using the amount of silt brought down by it to fill up the neighbouring depressions on a definite plan. As a result of the new measures then inaugurated, 300 sq. kil. of most fertile soil have been reclaimed for agriculture.

This historical introduction is followed by a detailed statement of the several reclamation works now in hand, and of the special operations—pumping, drainage, filling of depressions, and the like, necessitated by the varying conditions. In the Ravenna district, besides the operations on the Lamone, one of the most important reclamations is that of the "Standiana" to the south of the city. The area here in question is about 150 sq. kil., and as new agricultural settlements are already being started the whole aspect of the country, once almost uninhabited, will be changed before long. Near Ferrara the largest operations are those of the "Grande Bonificazione" (between the main stream of the Po and the "Po di Volano"), the beginnings of which go back to the sixteenth century, when the matter was taken in hand by the last Duke of Ferrara; and that of the Polesine di S. Giorgio south of

the Po di Volano. In the former area 1000 sq. kil. have already been reclaimed within recent years, and the hydraulic works are on a very large scale. The problems to be solved include not only the drainage of the water-logged depressions, but the provision of water for irrigation and drinking purposes. Further details must be sought in the paper itself, which extends to over fifty pages.

ASIA

Glaciers of Turkistan.

A type of glacier peculiar to Turkistan is discussed by R. von Klebelsberg in the *Zeitschrift für Gletscherkunde*, February 1926, on the basis of observations made during the Deutsch und Osterreich. Alpenverein's expedition of 1913. The glacier chiefly dealt with is the Borolmas glacier on the north side of the eastern chain of the Peter the Great range. A map from stereo-autographic surveys by W. Deimler, on the scale of 1/50,000, follows, with some notes on its construction by O. von Gruber. The first contrast with Alpine glaciers is the absence of a snowfield from which the glacier would be fed. The glacier begins in the steep-walled head of the valley, which descends smoothly between almost vertical sides. The yearly movement near the head was calculated at 95·8 metres. The annual rate below the junction with the main tributary was 89·8 metres. The glacier is also fed by hanging glaciers, and, below the snow-line, by avalanches. The surface at its head is concave, but a few hundred metres below it runs level from wall to wall and is free from *débris* or large crevasses. At approximately the 4000-metre line, strips of *débris*-covered ice of increasing width begin to accompany the glacier, at angles of less than 45° with the banks upstream. Farther down the *débris* on the surface increases rapidly, until it is entirely covered. This accumulation is due to the small rate of fall of the glacier and to its rapid melting. The fresh and vegetationless moraines are those of a rapidly diminishing glacier. Below the termination of the " normal " glacier, at 3600 metres, lies a cut-off and abandoned portion, which continues down the valley for 2 kilometres, having a contorted and rock-covered surface. In general, its moraines are also fresh in appearance, but there is some vegetation in favourable positions. Its terminal moraine would be taken as marking a stage in a retreat but for the presence of the ice above it. Below there is a series of old terminal moraines, from which it may be gathered that during the second stage discernible the glacier had broken out through the left-hand moraines of the first series.

Elsewhere in this region, observations have been made which supplement those of the Borolmas glacier, and which show that the glaciers here are either dead or dying. The writer believes that the period at which the lower portion split off may be correlated with the 1850 Alpine stage, and that the condition of the whole glacier points to a sudden cessation of supplies of snow. This he does not attribute to changes of climate, but to the morphological features in conjunction with seismic activity. The remarkable advance could have been produced by a sudden increase of supplies from avalanches generated by seismic action : this the morphological conditions could have increased through the steepness and height of the walls and through the narrow valley holding up and concentrating the accumulation at the head of the glacier.

AFRICA

Phosphate Deposits in Egypt.

The vital importance to agriculture of a constant supply of phosphate, and the comparatively small extent to which phosphate rock is present in nature,

gives an interest to any efforts to extend the sources of supply. The two main producers of the mineral are the United States and North Africa (principally Algeria and Tunis), though promising discoveries have also been made in Canada and elsewhere. The first discovery of phosphates in North Africa was as recently as 1873, and the extension of the phosphate-bearing strata to Egypt has been demonstrated still more recently, though some amount of commercial exploitation has already taken place. A detailed review of the Egyptian phosphate deposits, by Dr. W. F. Hume, Director of the Geological Survey of Egypt, has appeared this year as *Survey of Egypt Paper* No. 41. In 1898 M. Fourtau had suggested that phosphates would be found in the Upper Cretaceous strata, particularly in Dakla oasis, and in the same year the actual discovery of extensive beds in that oasis was made by Mr. Beadnell. In 1897 Mr. Barron discovered phosphate beds in Gebel Qurn near Qift in the Nile valley, and in the next year an exploration of the eastern desert by him and Dr. Hume revealed the existence of deposits of Cretaceous age in Wadi Hammama, east of Qena, and in the coast districts near Qoseir and Safaga. In the Nile valley attempts at exploitation began in 1908 and were continued after 1913 by the "Società Egiziana per l'Estrazione ed i commercio dei Fosfati." But the lack of cheap transport for the product caused the enterprise to be abandoned in 1925. On the Red Sea coast the results have been more satisfactory, and the deposits near Safaga are now being worked by the "Egyptian Phosphate Company" (formed in 1910), and those further south, at Gebel Duwi, Hamadat, etc., by the Società Egiziana. Lack of communication has precluded any attempts at exploitation in the Libyan Desert area, and the whole Egyptian industry is handicapped by the high rates for transport to the European market, which make it impossible to compete with the mines of Tunis and Algeria. The only markets open are those of Japan and South Africa, and the needs of these are relatively small. But the existence of rich deposits is now beyond question. It is estimated that at Gebel Duwi there exist not less than 5,000,000 tons with a tricalcic phosphate content of 66 to 68 per cent., and the Hamadat area might yield still more, though this has not been definitely proved. The paper gives full details as to the relation of the beds in the various areas to the geology, and is illustrated by geological and other maps and photographs. It is stated that the formation in which the beds occur is the same as in Tunis, Algeria, and Morocco, though separated by so wide an interval, one of the beds being marked here too by an overlying band of dark silex.

AMERICA

Two Andine Glaciers.

We have received from Mr. J. Cochrane some descriptive notes upon the Horcones and Fitzgerald glaciers, west and east of Aconcagua respectively. Mr. Cochrane had accompanied Mr. M. F. Ryan on his ascent of Aconcagua in 1925 (which was described, with photographs, in the *Journal*, July 1925), and had made further climbs this year. These two glaciers present considerable contrasts to each other, through the topographical and geological features of their surroundings. The Horcones glacier lies to the west of the great mass of Aconcagua, consequently it receives more moisture and snow from the westerly winds, which are relatively drier when they reach the eastern slopes above the Fitzgerald glacier. Thus the Horcones glacier is fed from a snowfield of abundant and clean snow. The supply of snow is probably also increased by the position of Cuerno peak (18,216 feet) north of the glacier.

Further, this peak is composed of hard andesite rocks, exceedingly resistant to weathering. These do not break up into small pieces, so that the snowfield at the base is free from *débris*. Further down, the valley occupied by the glacier narrows, being blocked by the slopes of " Catedral " peak (18,023 feet) from the west and of Aconcagua from the east. The glacier is thus triangular, with a length of approximately 2½ miles, and a fall of 2000 feet. At one point its bed is interrupted by a hollow, into which the ice flows and is then forced over a ridge to continue its course. Probably owing to the great pressure much melting takes place in this hollow, and the surface is covered with rivulets intersecting the " nieve penitente." Here also much *débris* collects from the mountain slopes, but in crossing the ridge below it is engulfed in crevasses, and the glacier regains its previous whiteness.

In contrast with the dazzling appearance of the Horcones glacier is that of the Fitzgerald. From its position, its supply of snow is, in the first place, smaller. Then it is subjected to heavy rock-falls from Aconcagua, which cover the surface so thickly with *débris* that the ice is often indistinguishable as such. These rock-falls are due to the geological character of Aconcagua. The mountain is called " volcan," but it is really carved out of the haunch of an ancient volcanic cone. Volcanic activity began while the sedimentary rocks still lay unhardened upon the ocean floor. Much uplifting took place gradually, and portions of these sedimentary rocks are fixed in the volcanic. These inclusions in the volcanic rocks are extremely friable, and since they line the valley walls of the Fitzgerald the detritus covers the glacier and shines like coal at a distance. In further contrast to the Horcones, the total fall of the Fitzgerald is slight, its course approximately 7 miles, and its surface unbroken. The quantities of fine silt carried away by the Horcones river, which is also fed by the Fitzgerald, contribute to the fertility of the Mendoza vineyards.

Economic Condition of British Guiana.

In pursuance of the practice of bringing Members of Parliament into closer touch with the affairs of British colonies and territories, the Secretary of State for the Colonies appointed a Parliamentary Commission last year to visit British Guiana. The Commissioners were Messrs. R. Roy Wilson and H. Snell, and their recently published Report gives a concise survey of present conditions in that colony. The terms of reference were to " consider and report on the economic condition, the causes which have hitherto retarded and the measures which could be taken to promote development." The historical and constitutional issues cannot be discussed here, though they have curbed progress to prosperity. The country falls roughly into two main divisions, the lowland coastal belt, almost entirely agricultural, and requiring heavy expenditure of capital to preserve it from the inroads of floods and droughts; and the interior, covered with vast and valuable, but hitherto undeveloped, forests, and at present, apart from a few thousand forest Indians, inhabited by gold and diamond miners. The conservatism of the agriculturists has led to concentration on the one staple crop, the sugar-cane, and recent developments in the world sugar market have made this concentration particularly dangerous. In 1836, the value of sugar and bye-products exported was £1·8 million, or 84 per cent. of the total exports. For 1925 the figure was £1·6 million, or 53 per cent. of the total. The difference in the proportion to the total exports is due to the output of alluvial diamonds, admittedly of uncertain duration and liable to fluctuation. Broadly generalizing, the coastal area produces 59 per cent. of the exports (sugar and rice),

and the interior 41 per cent. (diamonds, bauxite, balata, and gold). As agriculture in the lowlands requires heavy capital expenditure, it is difficult to settle labour permanently on the land, especially as the sole source of supply is from immigration. Formerly, the East Indies were the chief origin of immigrants, so that 43 per cent. of the population is East Indian. This supply has now been stopped, and the Commission recommends that, instead of embarking upon expensive schemes to re-open this channel, immigrants from the British West Indies should be encouraged. It also advises the development of other crops, particularly improvement of rice-growing, by inspection and grading, and the introduction of ground-nuts as a commercial export. It is believed that the conditions would permit the latter to compete satisfactorily with the West African supply.

The colony naturally hesitates to embark upon big schemes at a time of agricultural depression, but there is one resource which would repay careful investment, that is the timber. A Forest Service is now at work, and preliminary surveys have shown the existence in the triangle between the Essequebo, Mazaruni, and Kaburi rivers of valuable forests of greenheart (of which British Guiana is the sole source), mora, and other species. These supplies are very accessible, some being within 10 miles of a deep-water port. As the most satisfactory method of exploitation, the Commission recommends the creation of a Forest Trust, and refers to the possibility of applying to their conservation the knowledge which the Forest Indians have acquired through the centuries. The necessity for a permanent Forest Service is urged, and also the continuance of topographical and geological surveys after the route for the Mazaruni goldfields railway has been selected. This line will probably run from Bartica on the Essequebo to the Tiboko falls on the Upper Mazaruni, but is still under consideration. It would also tap the forest area already mentioned. In general, railways are recommended as the only suitable means of communication under tropical conditions. The future of Georgetown Harbour, the one port for ocean-going vessels, is a cause of anxiety, as it is in danger of silting up. All these developments, with educational and sanitary requirements, necessitate financial and political reform, and it is to this end that the Report is largely directed.

Scientific Research in Bolivia.

An important journey in the region of Lakes Titicaca and Poopo was undertaken last year, with the support of various German bodies, by Dr. K. Troll of Munich, who describes some of his results in *Petermanns Mitteilungen*, 1927, Nos 1/2 and 7/8. The programme laid down was very extensive, and included a study of the geology and morphology of the Bolivian Altiplano and its surrounding ranges, as well as of the vegetation, and the agriculture, actual and potential. The La Paz valley was first examined and its relation to the glacial epoch made out. A careful study of the shores of Lake Titicaca and its ancient terraces was next made, and it was ascertained that the highest level (representing the Lake Ballivian of Bowman) was considerably older than the last ice-age. The next piece of work was the examination of the Cordillera and its eastern escarpment between Illampu and Apolobamba, where little had been known of the direction taken by the crest of the range and its relation to the hydrography. The conditions were found very similar to those of the La Paz system, the range being several times broken through by the Rio Mapiri, so that here too the water-parting is merely the sharply cut edge of the Altiplano. As in the case of the La Paz, the trenching was

pre-glacial. Dr. Troll was able to join Prof. A. Possnansky in a descent of the Desaguadero from Titicaca to Poopo in a motor boat, this being the first occasion on which the whole course of the river had been navigated. It led to the discovery that the river has since 1922 shifted its course considerably to the east before entering the lower lake. While traversing the Pampa north of Poopo (which is dry and not swamp as shown in the 1/M map of the American Geographical Society) the river flows at a slightly higher level than the surrounding plain, and its bank seems to have been breached at high water. Much attention was paid to the history of the lake basins in recent geological times, and some of the conclusions of Bowman as to the relations of the two ancient lakes (" Ballivian " and " Minchin ") are considered to be incorrect. Both the modern lakes have shown a decided rise in level of late years. This had been known for some time as regards Titicaca, but Dr. Troll was able to establish the fact for Poopo also, where much vegetation on the banks has been killed by the flooding. It seems that the cause is a climatic one. Even though the journey was made at the end of the dry season, Poopo was found to be discharging by the Lacahuira river towards the " Salar " of Coipasa, although the lake has been held (as by Neveu-Lemaire of the French Commission of 1903) to have no outlet. (May not the discharge be a recent phenomenon, due to the rise in the level of the lake ?) Dr. Troll ends by speaking of small remnants of primitive inhabitants that are still to be met with on the Altiplano, distinct from the Aimara and Quechua, and discusses recent projects for using the Desaguadero for navigation and irrigation. At the time of writing he was continuing his researches.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Erosion in Arid Lands.

The calculation of the rate of erosion over the large area of a river-basin does not now present great difficulties. A similar calculation for a particular limited area is much less common. The results of observations by Messrs. Kirk Bryan and E. C. La Rue on the Navajo Twins, Utah, given in the *Geographical Review* for April 1927, though not quantitative, are therefore of interest. The " Twins " are two pillars which rise from the northern scarp of the San Juan River valley, and are formed of Upper Jurassic sandstone with developed vertical joints overlying red shale with sandy bands. Though their fall appears imminent, yet a comparison of two sets of photographs taken from the same spot at an interval of fifty years (W. H. Jackson, 1875 ; La Rue, 1925) shows no visible change to have taken place. Many of the boulders in the detritus at the foot of the cliff have been carried away for building purposes, but others remain apparently unchanged, including one resting upon a pedestal of shale. Enlargements of a portion of the cliff wall also show that changes in the carving of the bands of shale and sandstone cannot be detected. From the fragmentary records, the climate is one of prolonged drought broken by torrential rains, with a daily range of temperature of 40° to 50°, conditions very favourable to rock disruption. These observations discredit the general idea of the rapidity of erosion in arid lands, an idea attributed by the authors to the great changes which the torrential streams work in their beds, thus conveying an impression of much erosion and constant change.

HUMAN AND HISTORICAL GEOGRAPHY

A New View of the Atlantis Problem.

To the many previous theories put forward in explanation of Plato's story of the sunk land of Atlantis, yet another has been added by Paul Borchardt in the first number of *Petermanns Mitteilungen* for 1927. While there is perhaps little likelihood of its prompt acceptance by rival theorists, its plausibility cannot be denied, and it appears to fit in much better than most with the details given by Plato. Borchardt places the lesser island of Atlantis—the actual seat of the king, to be distinguished, as by Plato himself, from Atlantis in its wider sense—a few miles inland from the head of the Gulf of Gabes, in the region of "Shotts" which represent a former water-area connected with the Mediterranean. In accord with the very different connotation often attaching to the word "island" in early times, he identifies the wider Atlantis with the main block of North Africa, physically so sharply cut off from the rest of the continent. Plato's Atlantic Sea (better "Sea of the Atlantes") becomes the inland gulf, of which the Shott Melghir (30 metres below sea-level) is now the last remnant, and which there is little doubt was formerly connected with the Mediterranean by a continuous channel. The engulfment of Atlantis by a great convulsion of nature becomes therefore the destruction through an earthquake of the island on which the capital with its temple, etc., was placed. At first sight this view may appear startling, but it stands the test of closer examination better than might be supposed. While all previous writers have taken for granted that the "Atlantic Sea," lying *beyond* the Pillars of Hercules, must be our Atlantic Ocean, Borchardt considers this by no means beyond question. Plato expressly states that "This our sea" (*i.e.* in Borchardt's view the sea under discussion at the moment) is in reality only a gulf with a narrow entrance, and that "that which is in reality a sea" is itself *surrounded* by continental land. The latter cannot be the outer ocean, but must refer to the Mediterranean, so that the "Sea of the Atlantes" will be merely an embayment of the latter. The "Pillars of Hercules" may have been understood by the Egyptian priest in a different sense from that usually applied to them by the Greeks, for it is to be remembered that the original Libyan names were throughout translated into Greek forms for the benefit of Solon. There may well have been a confusion between the "Pillars of the Heavens" (by which the modern Atlas and a second African range appear to be meant) and the Pillars of Hercules, or even between the latter and the actual pillars of one or other of the temples dedicated to the hero.

Borchardt holds that the broad features of the region of the Shotts agree well even to points of size with Plato's description of a rectangular plain, open to the south but sheltered on the north by mountains, the irrigation canals which surrounded it being represented by the Igharghar and other streams now largely buried by the encroaching sands. Many facts indicate that, like the Tarim basin in Asia, this tract was formerly the seat of considerable civilization, the destruction of which was due to similar causes. The separation of the interior basin from the sea is to be accounted for by the formation of a transverse sill by a tectonic disturbance, to which the district is known to have been liable. While fully aware of the danger of laying too much stress on resemblance of names, Borchardt is able to show a remarkable affinity, either in form or meaning, between Plato's names for the sons of Poseidon, and many existing Berber tribal denominations; and he derives the name Atlantes from At-tala, the Berber equivalent for the Beni Hammama ("Sons of the

Hot Springs") now dwelling in the region of the Shotts. In a short summary it is impossible to do justice to all the author's arguments, but it should be mentioned that further support for the theory is found in the close agreement between Plato's account and the description of Lake Triton of Herodotus and others, with its temple-crowned island.

POLAR REGIONS

Dr. Lauge Koch's Expedition to Scoresby Sound.

The *Times* of August 5 reports that a wireless message has been received from Scoresby Sound stating that Dr. Koch's party were well and had returned to Scoresby Sound on June 1 from an 800-mile sledge journey. During the winter Dr. Koch's companions, apart from Eskimo dog drivers, were a Danish palæontologist and Mr. T. M. Harris, a palæobotanist from Cambridge; but it is not stated in the message whether either of these accompanied him on the long expedition. When the Cambridge party visited Scoresby Sound last August, Dr. Koch had given up his plan of crossing Greenland to the west coast, and contemplated a geological expedition in the early spring from Scoresby Sound northwards *viâ* the interior fjords. The report that he has now completed an 800-mile journey with dog sledges implies that he has been successful and has in all probability reached Sabine Island. There was no wireless installation at Scoresby Sound last summer, but it was intended to erect a station on the arrival of the relief ship this year. The wireless message therefore indicates that the relief ship has arrived, and this explains how Dr. Koch's return to his base on June 1 was not announced until August.

Weddell Sea and Peter I. Island.

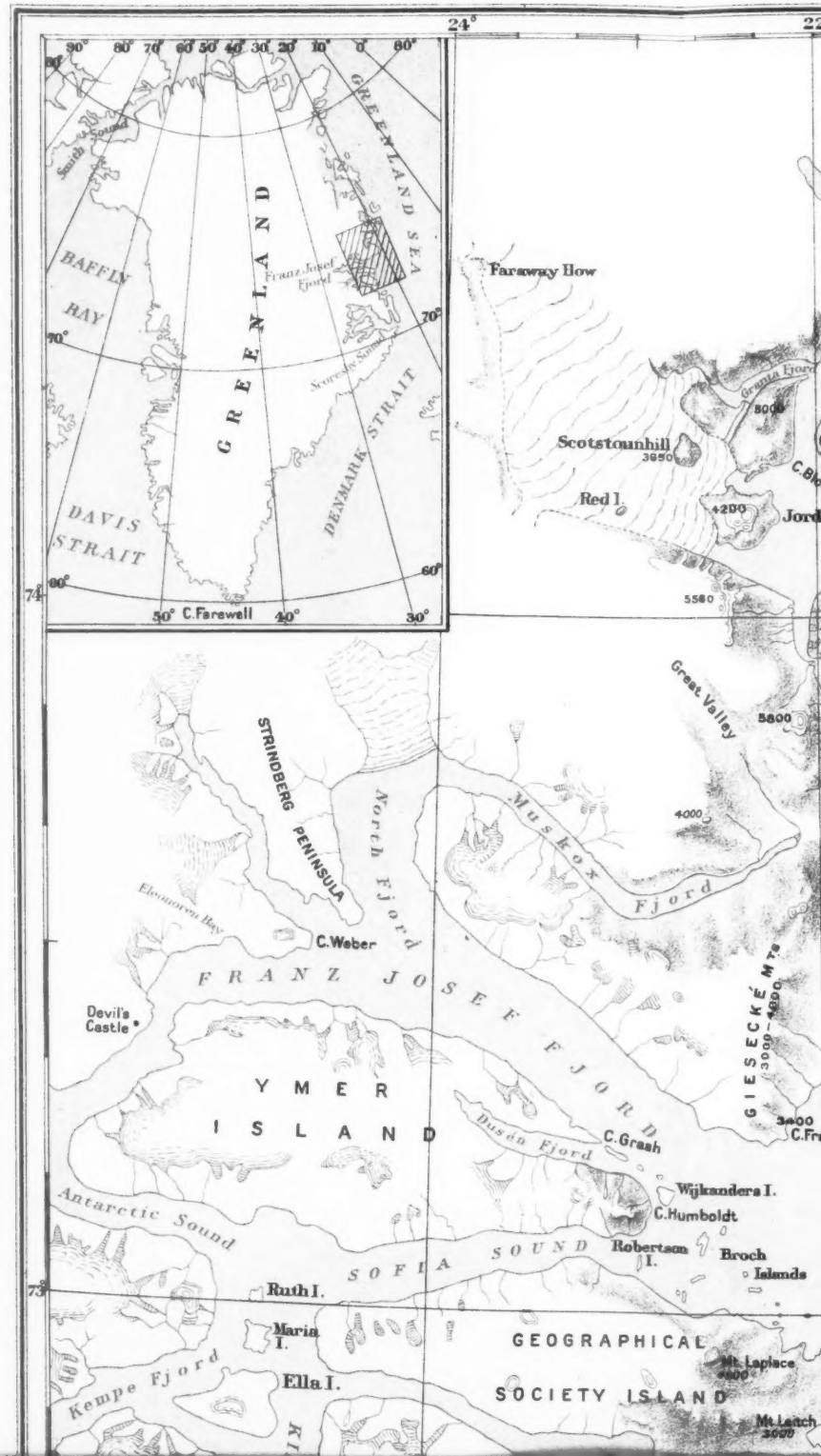
R.R.S. *Discovery* reports numerous tabular bergs of unusually large size sighted in February last between the South Orkneys and Graham Land. On February 22 in 60° 48′ S., 51° 13′ W. she steamed past a berg 35 miles in length on its northern side: from the north-west corner it extended beyond the horison to the south and it had a fairly uniform height of 150 feet. Again, when near Clarence Island on the 23rd the sea to the south was reported as crowded with enormous tabular bergs, one of which extended across the horizon, so that no limits could be seen to it.

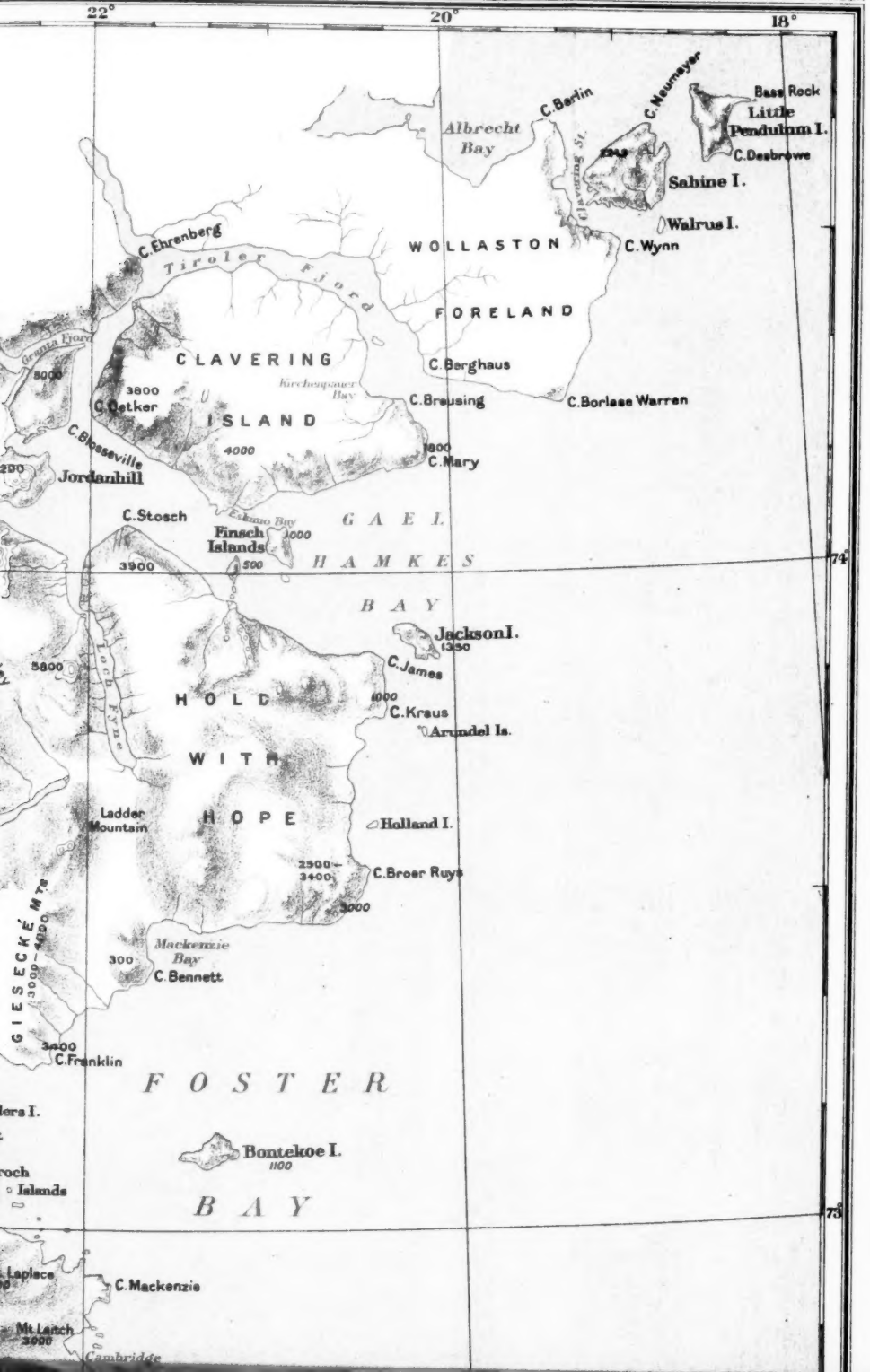
The Norwegian whaler *Odd I* records a still longer berg sighted on January 7 in 60° 30′ S., 52° W. *Odd I* steamed along the north side for nine hours at a steady rate of 10 knots. The cliffs, which were sharp in outline, rose 100–130 feet above the water-line. From the most westerly point the berg extended right to the south horizon, with characteristic ice-blink: the observers thought that it might be 100 miles in length along this west side. It is just possible that this is the same berg as that sighted by the *Discovery* in much the same locality six weeks later; but if this view is to be held it indicates partial grounding and a swing through 90 degrees, so that the *Discovery* passed along the shorter side. Shackleton experienced strong currents when approaching Elephant Island, so that grounding is a necessary inference should the bergs be identical. The *Discovery* under the lee of the 35-mile berg had soundings of 2514 m. and 1849 m. about 1 mile apart; it is suggested, in fact, that there is a ridge here of not more than 1100 m. depth. A barrier berg 150 feet high would ground in about 300 m. The *Discovery* officers, while not contemplating the identity of the bergs, considered that the 35-mile berg was quite possibly aground.

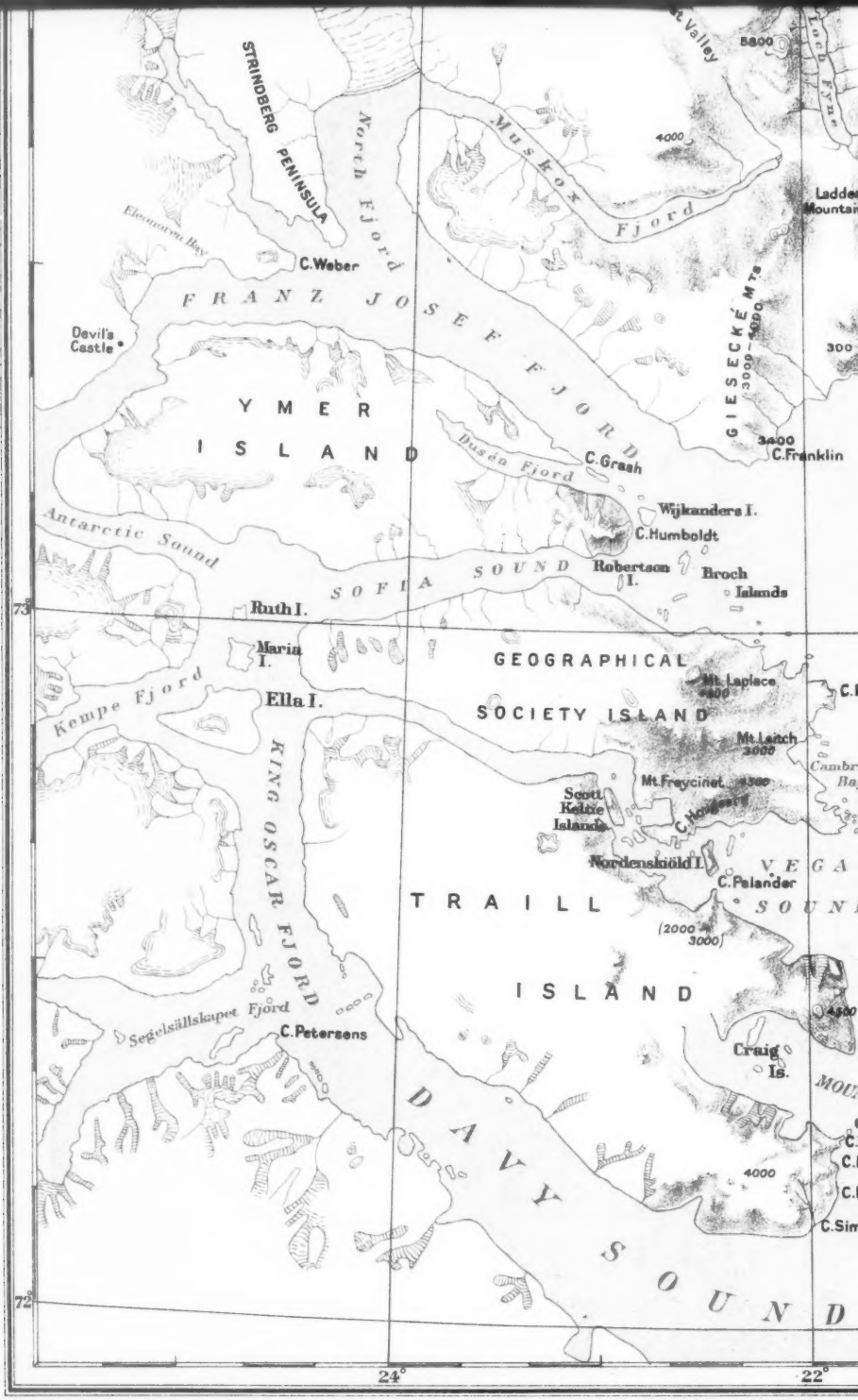
The drifts in the Weddell Sea are now well known as a result of Shackleton's voyage in the *Endurance*, and there can be no question that the large tabular bergs reported this year have drifted up from the head of that sea. They may be portions of the Wilhelm Barrier, partially explored by Filchner in 1912. It seems more likely, however, that one at least of these big bergs represents the Stancomb Wills Promontory discovered by Shackleton on Coats Land in 74° S. The *Endurance* followed the promontory round three sides, so that its dimensions were at least 70 miles by 40 miles. Reference to observations made at the time indicates cliffs averaging 100 feet in height; very rarely was the height lower than this, and the only possible landing-place was on the north-west front. At one time those on board the *Endurance* considered that they were encircling a vast berg, but later this gave place to the view that the promontory was a great ice-barrier tongue solidly attached to the land, but afloat in its outer portion. Soundings of 103 and 268 fathoms were obtained close in to Coats Land, but at the north-west edge the depth was 1355 fathoms. These facts are all consistent with the view that the berg sighted by *Odd I* is the Stancomb Wills Promontory broken adrift.

The later voyage of *Odd I* is also of interest. From Bransfield Strait she proceeded south-westwards, and on January 17 succeeded in reaching Peter I. Island (69° S., 90° W.). The island has not apparently been visited since its discovery by Bellingshausen in 1821, at which date it was the most southerly land known. *Odd I* passed round the south point and steamed up the west coast, seeking a harbour. The island was found to trend S.E. to N.W., being 8 miles in length by about 5 in breadth. A complete circuit was made, but without finding a harbour which could be depended on in all winds. Owing to heavy swells it was not found possible to make any landing. Nine-tenths of the island is snow or ice-covered, and it is only on the western side that much bare rock appears. The mountains there are described as made up of red and red-brown layers, characteristically shown at Cape Ingrid Christensen on the west coast. Volcanic rocks were brought up during sounding. A little farther north on this same side at Sandefjords Bay the rocks are yellow and contorted. For the most part, however, the coast is an ice-cliff 50 to 70 feet in height; the ice surface slopes gently back towards the 4000-feet Lars Christensen Peak. There was no "ice foot" along the land, and on this account it was considered that the island is free of pack-ice the whole year round.

On the return voyage *Odd I* took a more southerly course, but failed to see land owing to fog, though at one time within 60 miles of Charcot Land. Her route took her along the pack edge on a north-easterly course, Anvers Island being reached on January 21.


24°
90° 80° 70° 60° 50° 40° 30° 20° 10° 0 80°
Smith Sound
GREENLAND SEA
BAFFIN BAY
Franz Josef Fjord
GREENLAND
Scoresby Sound
DENMARK STRAIT
DAVIS STRAIT
70°
60°
50° C. Farewell
40°
30°
Faraway How
Grania Fjord
8000
Scotstounhill
3850
Red I.
4200
5560
Great Valley
5800
4000
Muskox Fjord
STRINDBERG PENINSULA
North Fjord
Eleanora Bay
C. Weber
FRANZ JOSEF FJORD
GIESECKE Mts
3000-4000
Devil's Castle
YMER ISLAND
Dusén Fjord
C. Grash
3400
Wijkanders I.
C. Humboldt
Antarctic Sound
SOFIA SOUND
Robertson I.
Broch Islands
Ruth I.
Maria I.
Kempe Fjord
Ella I.
GEOGRAPHICAL SOCIETY ISLAND
Mt. Lapisce
4000
Mt. Leitch
3000


22°
20°
18°
Albrecht Bay
C. Berlin
C. Neumayer
Bass Rock
Little Pendulum I.
C. Desbrowe
Clavering St.
Sabine I.
Walrus I.
C. Wynn
WOLLASTON FORELAND
C. Ehrenberg
Tiroler Fiord
Granta Fiord
CLAVERING ISLAND
C. Berghaus
Kirchesquinet Bay
C. Bruising
C. Borlase Warren
C. Getker
C. Blosseville
Jordanhill
C. Mary
C. Stosch
Eskimo Bay
Finsch Islands
GAEL HAMKES BAY
74°
Jackson I.
C. James
HOLD WITH HOPE
Loch Fyne
C. Kraus
Arundel Is.
Holland I.
Ladder Mountain
C. Broer Ruys
GIESECKÉ MTS
Mackenzie Bay
C. Bennett
C. Franklin
FOSTER BAY
Bontekoe I.
Islands
73°
C. Mackenzie
Mt. Latch
Cambridge



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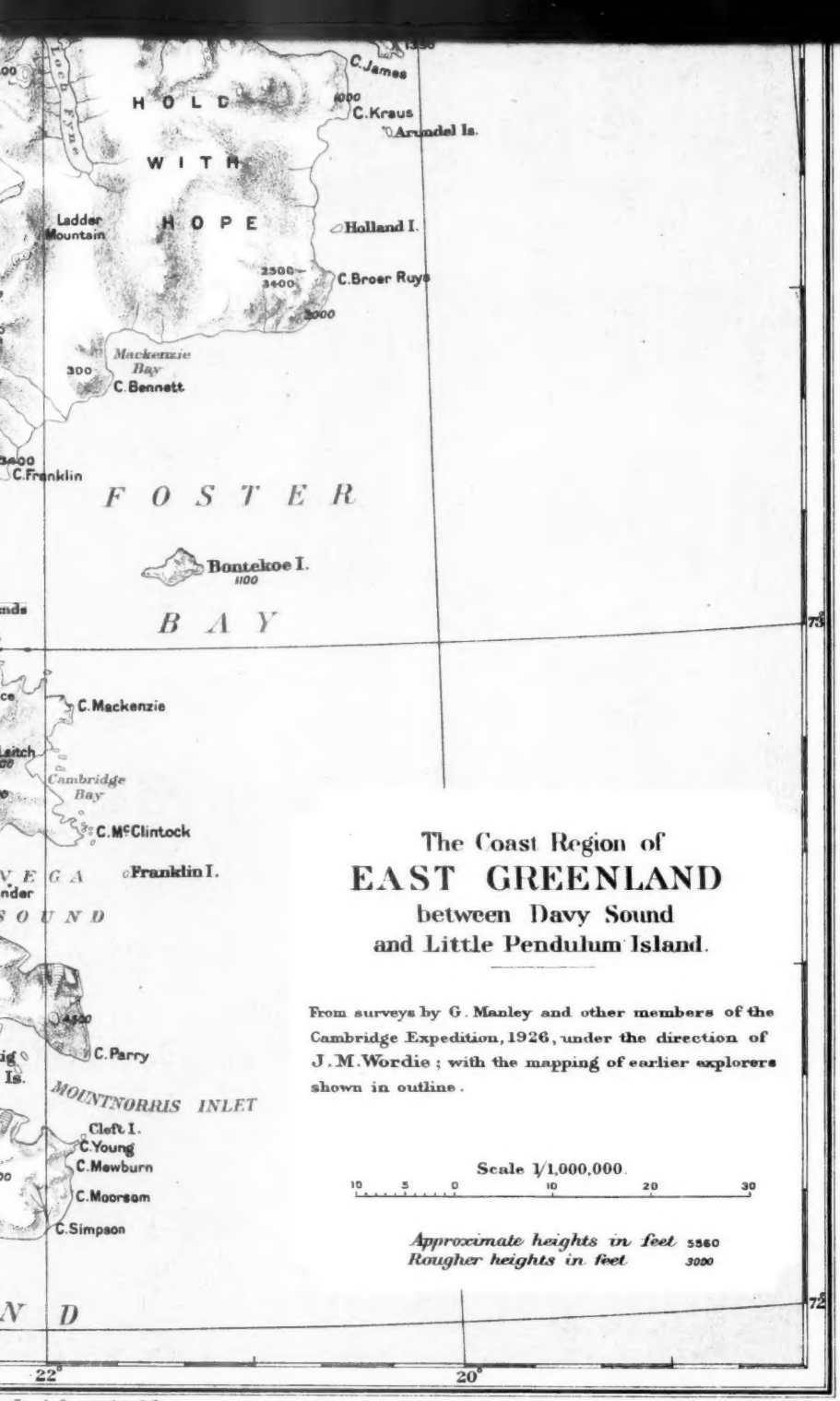

The Coast Region of
EAST GREENLAND
between Davy Sound and Little Pendulum Island.

From surveys by G. Manley and other members of the Cambridge Expedition, 1926, under the direction of J. M. Wordie; with the mapping of earlier explorers shown in outline.

Scale 1/1,000,000.

10 5 0 10 20 30

Approximate heights in feet 5560
Rougher heights in feet 3000

e Royal Geographical Society

EAST GREENLAND.
Wordie.